The Research Council of Norway (NFR)

NORSAR

NORSAR Scientific Report No. 2-94/95

Semiannual Technical Summary

1 October 1994 - 31 March 1995

Kjeller, May 1995

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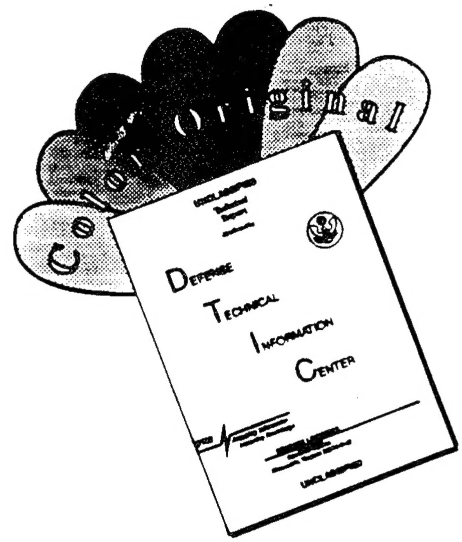

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This Semiannual Technical Summary describes the operation, maintenance and research activities at the Norwegian Seismic Array (NORSAR) , the Norwegian Regional Seismic Array (NORESS), the Arctic Regional Seismic Array (ARCESS) and the experimental Spitsbergen Regional Array for the period for the period 1 October 1994 - 31 March 1995. Statistics are also presented for additional seismic stations, which through cooperative agreements with institutions in the host countries provide continuous data to the NORSAR Data processing Center (NDPC). These stations comprise the Finnish Experimental Seismic Array (FINESS), the German Experimental Seismic Array (GERESS), the Hagfors array in Sweden and an experimental regional seismic array in Apatity, Russia.

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Abstract (cont.)

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This Semiannual Report also presents statistics from operation of the Intelligent Monitoring System (IMS). The IMS has been operated in a limited capacity, with continuous automatic detection and location and with analyst review of selected events of interest for GSETT-3. Data sources for the IMS have comprised all the regional arrays processed at NORSAR.

Since 1 October 1991, an effort has been undertaken to carry out a complete technical refurbishment of the NORSAR array. This project is funded jointly by AFTAC, ARPA and NFR. During the reporting period, work has continued on gradually installing new digitizers, communications modules and broad-band seismometers of the KS-54000 "posthole" type. New short-period seismometers of type Teledyne Geotech S-20171 have been ordered. The new data acquisition system is running satisfactorily.

On-line detection processing and data recording at the NORSAR Data Processing Center (NDPC) of NORESS, ARCESS, FINESS and GERESS data have been conducted throughout the period. Data from two experimental small-aperture arrays at sites in Spitsbergen and Apatity, Kola Peninsula, as well as the Hagfors array in Sweden, have also been recorded and processed. Monthly processing statistics for the arrays as well as results of the IMS analysis for the reporting period are given.

Maintenance activities in the period comprise preventive/corrective maintenance in connection with all the NORSAR subarrays, NORESS and ARCESS. Other activities have involved testing of the NORSAR communications systems, preparations for the NORSAR refurbishment and work in connection with the experimental small-aperture arrays in Spitsbergen and Russia.

Summaries of seven scientific contributions are presented in Chapter 7 of this report.

Section 7.1 is a paper entitled "Global seismic threshold monitoring and automated network processing", which was presented at the ARPA CTBT Monitoring Technologies Conference 1995. The paper summarizes recent research conducted at NORSAR aiming to develop, test and demonstrate advanced automated processing techniques for use in a global seismic CTBT monitoring system, and to implement and integrate these techniques into the processing at the International Data Center. It describes a global system for continuous seismic threshold monitoring which has been developed and implemented at the IDC. Other research summarized in the paper includes improved automatic onset time estimation of signal arrivals, special post-processing procedures for improving automatic event location accuracies and on-line regional generalized beamforming for reliable phase association of detected seismic events.

Section 7.2 is a paper entitled "Mapping of azimuth anomalies from array observations". This research is a continuation of the work reported by J. Schweitzer (1994) in NORSAR Scientific Report No. 1-94/95 entitled "Mislocation vectors for small aperture arrays - a first step towards calibrating GSETT-3 stations". For details on the database used, and on the method used for asso-

ciation of the observed onsets with theoretically estimated onsets, reference is made to the work mentioned above.

In this report we present the derived azimuth corrections for P-phases observed at the small-aperture arrays NORESS, FINESS, ARCESS and GERESS. The resulting database also contains azimuth corrections for other types of phases like Pg, Sn, and Sg, as well as ray parameter corrections relative to the IASP91 earth model. The data demonstrate convincingly that P-phases from events located within certain regions exhibit significant and consistent azimuth anomalies as observed on the different arrays.

Concerning the phenomena contributing to the observed anomalies, it has been shown by Kværna and Doornbos (1991) that structural inhomogeneities like Moho topography near the receiving arrays can significantly perturb the incoming wavefront. All phases with the same azimuth and apparent velocity should thus have the same azimuthal bias. But the azimuth anomalies often exhibit relatively strong variations over limited geographical areas. Local Moho inhomogeneities thus cannot explain all observed azimuth residuals, so the observed pattern of azimuth anomalies must also be the results of lateral heterogeneities along the whole ray path. For example, the pronounced change in the azimuth residual at GERESS for events from the far south-east from positive (Greece, Balkan) to negative (Italy) is mostly parallel to the boundary between the Adriatic and the European plate. These residuals will also be influenced by the Moho syncline forming the root of the Alps.

Section 7.3 is a paper entitled "NORSAR large array processing and time delay measurements". The paper briefly reviews the development of the large NORSAR array, which initially comprised a configuration of 22 subarrays distributed over a diameter of 100 km. After six years of experimental operation, the array was modified on 1 October 1976 to a reduced configuration which was more suitable for an automated, operational system, and the 7 best subarrays (in the NE part of the original array) were selected for this purpose. This configuration is still in operation today, with each subarray comprising 6 SP and one 3-component BB seismometer over an area 8 km in diameter. The total aperture of NORSAR is now 60 km. This array configuration enables excellent teleseismic detectability and location capability. A complete technical refurbishment of the NORSAR array is now being finalized.

In order to take full advantage of the NORSAR capabilities, it is desirable to update the beam deployment and revise the time delay anomalies taking into account the improved precision made possible from the increased sampling rate (40 Hz against previously 20 Hz) and the accumulated data base of reference events. This paper gives a progress report on the work carried out until now.

Section 7.4 is a paper entitled "Magnitude estimation using the IDC Threshold Monitoring system". The paper addresses the question of developing a "unified" magnitude scale for operational use at the GSETT-3 IDC. Such a magnitude scale should have the following general characteristics:

- Consistent with current teleseismic m_b
- Applicable to "all" distance ranges
- Computed automatically
- Valid over large magnitude range (at least 2.0-6.5)

The primary purpose would be to develop a 'generic" magnitude scale that could be used as a first estimate of m_b. Subsequent refinements would then be possible by introducing station/region-specific correction factors in areas where adequate data is available.

This paper describes a possible approach to developing a unified magnitude scale, by using the IDC Threshold Monitoring (TM) system. By analyzing selected IDC-reported events in detail, it is found that the TM approach offers a consistent, automatically computed data set that is directly applicable to m_b estimation. It is also pointed out that a similar approach can be used to estimate M_s, with upper 90% M_s limits provided automatically for events for which no surface wave is detected.

Section 7.5 is a paper entitled "Processing of Spitsbergen array data". This paper describes a study undertaken to improve the operational automatic detection processor for Spitsbergen currently applied at the IDC as well as at NORSAR. The main problem has been a large false alarm rate and poor f-k estimates of slowness and azimuth. By appropriate prefiltering of the data and extending the slowness estimation window, we have succeeded in developing some clear improvements in off-line processing of Spitsbergen data, but so far it has not been possible to duplicate these results at the IDC. Our conclusion is that the choices for prefilters before the IDC f-k analysis are too limited, but we also understand that this situation will be rectified with the introduction in the IDC processing of the new DFX code.

Section 7.6 is a paper entitled "Study of underground mining explosions in the Khibiny Massif". More than 100 underground mining explosions have been carefully analyzed, with data on explosive yield and shot practice provided by the mining authority. Comparison of the yields with local magnitude (M_L) and coda magnitude (M_C) shows clear correlation in both cases. This contrasts to previous studies, using both open and underground explosions, where no direct correlation has been found. These different results are attributed to a number of factors, notably the different shot practice for open and underground explosions.

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NORSAR Contribution No. 557

Table of Contents

1 Summary

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2 NORSAR Operation

2.1 Detection Processor (DP) operation

There have been 96 breaks in the otherwise continuous operation of the NORSAR online system within the current 6-month reporting interval. The uptime percentage for the period is 99.6 as compared to 99.3 for the previous period.

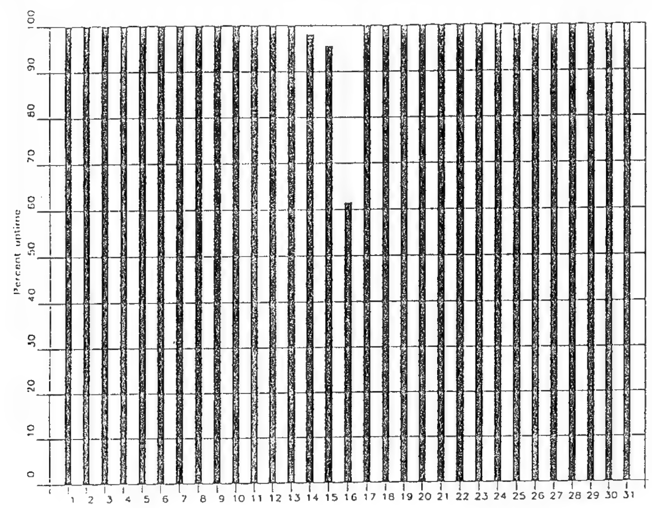
Fig. 2.1.1 and the accompanying Table 2.1.1 both show the daily DP downtime for the days between 1 October 1994 and 31 March 1995. The monthly recording times and percentages are given in Table 2.1.2.

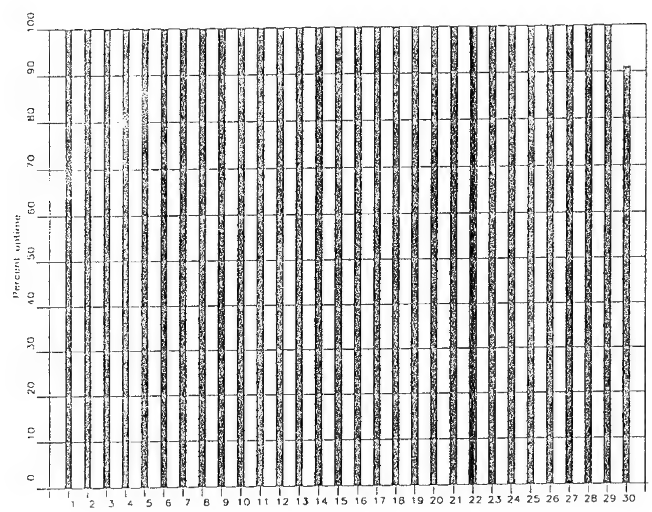
The breaks can be grouped as follows:

a)	Hardware failure	0
b)	Stops related to program work or error	3
c)	Hardware maintenance stops	0
d)	Power jumps and breaks	1
e)	TOD error correction	0
f)	Communication lines	92

The total downtime for the period was 5 hours and 12 minutes. The mean-time-between-failures (MTBF) was 1.9 days, as compared to 16.1 for the previous period.

J. Torstveit





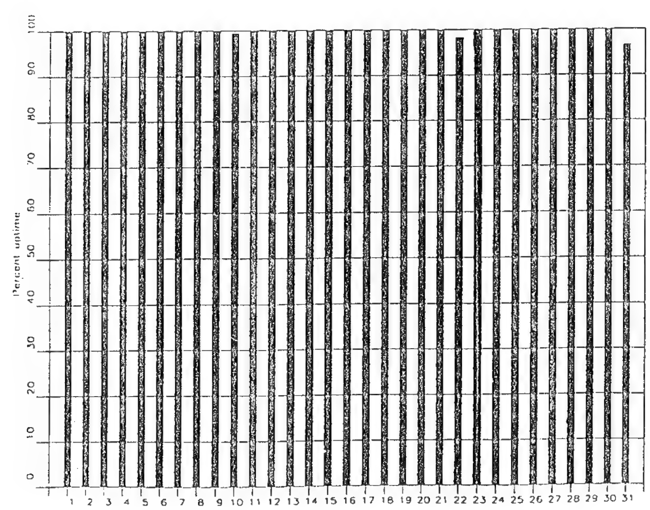


Fig. 2.1.1. Detection Processor uptime for October (top), November (middle) and December (bottom) 1994.

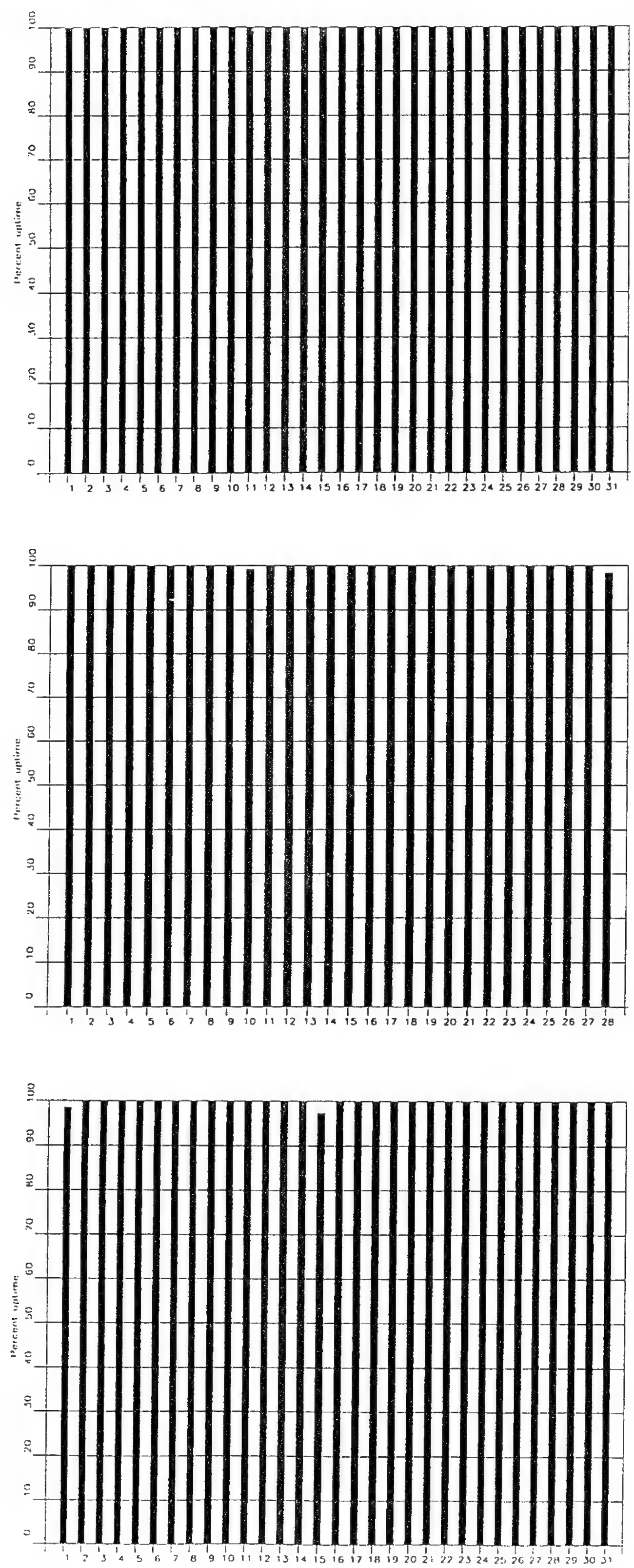


Fig. 2.1.1. Detection Processor uptime for January (top), February (middle) and March (bottom) 1995.

Date	Time	Cause
15 Oct	2225 -	Power break
16 Oct	- 0914	
30 Nov	0617 - 0826	Software work
31 Dec	2311 - 2400	Clock failure
28 Feb	1229 - 1258	Software failure
01 Mar	1004 - 1026	Line failure
15 Mar	0842 - 0918	Line failure

Table 2.1.1. The major downtimes in the period 1 October 1994 - 31 March 1995.

Month	DP Uptime Hours	DP Uptime %	No. of DP Breaks	No. of Days with Breaks	DP MTBF* (days)
Oct 94	733.14	98.54	40	19	0.7
Nov 94	717.49	99.70	17	15	1.7
Dec 94	743.59	99.81	31	18	1.0
Jan 95	743.93	99.99	1	1	15.5
Feb 95	671.56	99.91	3	2	7.0
Mar 95	743.09	99.86	4	3	6.2
		99.64	96	58	1.9

*Mean-time-between-failures = total uptime/no. of up intervals.

Table 2.1.2. Online system performance, 1 October 1994 - 31 March 1995.

2.2 Array Communications

As described in the previous Semiannual Report, the Modcomp/SLEM-based communication system experienced serious problems toward the end of 1993.

As an intermediate solution, it was decided on 1 January 1994 to implement a backup version of the NORSAR recording system, thus eliminating the Modcomp/SLEM-based recording. This change succeeded in improving both the timing reliability and the individual subarray uptimes.

In October 1994, the installation of a new data acquisition system began, in connection with the NORSAR Refurbishment. Details on this installation are given in Section 4.1 of this report.

During the reporting period, the communication lines to all subarrays except 02B and 06C were in operation essentially 100% of the time. Subarrays 02B and 06C were inoperative during parts of the reporting period in connection with testing and preparation for the NORSAR refurbishment.

A simplified daily summary of the communications performance for the seven individual subarray lines is summarized, on a month-by-month basis, in Table 2.2.1.

F. Ringdal

Table 2.2.1 (page 1 of 6)
NORSAR Communication Status Report
Month: October 1994

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	X	A	X	X	X	A
02	X	X	A	X	X	X	A
03	X	X	A	X	X	X	A
04	X	X	A	X	X	X	A
05	X	X	A	X	X	X	A
06	X	X	A	X	X	X	A
07	X	X	A	X	X	X	A
08	X	X	A	X	X	X	A
09	X	X	A	X	X	X	A
10	X	X	A	X	X	X	A
11	X	X	A	X	X	X	A
12	X	X	A	X	X	X	A
13	X	X	A	X	X	X	A
14	X	X	A	X	X	X	A
15	X	X	A	X	X	X	A
16	X	X	A	X	X	X	A
17	X	X	A	X	X	X	A
18	X	X	A	X	X	X	A
19	X	X	A	X	X	X	A
20	X	X	A	X	X	X	A
21	X	X	A	X	X	X	A
22	X	X	A	X	X	X	A
23	X	X	A	X	X	X	A
24	X	X	A	X	X	X	A
25	X	X	A	X	X	X	A
26	X	X	A	X	X	X	A
27	X	X	A	X	X	X	A
28	X	X	A	X	X	X	A
29	X	X	A	X	X	X	A
30	X	X	A	X	X	X	A
31	X	X	A	X	X	X	A
Total hours normal operation	744	744	0	744	744	744	0
% normal operation	100	100	0	100	100	100	0

Legend :

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

Table 2.2.1 (page 2 of 6)
NORSAR Communication Status Report
Month: November 1994

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	X	A	X	X	X	A
02	X	X	A	X	X	X	A
03	X	X	A	X	X	X	A
04	X	X	A	X	X	X	A
05	X	X	A	X	X	X	A
06	X	X	A	X	X	X	A
07	X	X	A	X	X	X	A
08	X	X	A	X	X	X	A
09	X	X	A	X	X	X	A
10	X	X	A	X	X	X	A
11	X	X	A	X	X	X	A
12	X	X	A	X	X	X	A
13	X	X	A	X	X	X	A
14	X	X	A	X	X	X	A
15	X	X	A	X	X	X	A
16	X	X	A	X	X	X	A
17	X	X	A	X	X	X	A
18	X	X	A	X	X	X	A
19	X	X	A	X	X	X	A
20	X	X	A	X	X	X	A
21	X	X	A	X	X	X	A
22	X	X	A	X	X	X	A
23	X	X	A	X	X	X	A
24	X	X	A	X	X	X	A
25	X	X	A	X	X	X	A
26	X	X	A	X	X	X	A
27	X	X	A	X	X	X	A
28	X	X	A	X	X	X	A
29	X	X	A	X	X	X	A
30	X	X	A	X	X	X	A
31							
Total hours normal operation	720	720	0	720	720	720	0
% normal operation	100	100	0	100	100	100	0

Legend :

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

Table 2.2.1 (page 3 of 6)
NORSAR Communication Status Report
Month: December 1994

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	X	A	X	X	X	A
02	X	X	A	X	X	X	A
03	X	X	A	X	X	X	A
04	X	X	A	X	X	X	A
05	X	X	A	X	X	X	A
06	X	X	A	X	X	X	A
07	X	X	A	X	X	X	A
08	X	X	A	X	X	X	A
09	X	X	A	X	X	X	A
10	X	X	A	X	X	X	A
11	X	X	A	X	X	X	A
12	X	X	A	X	X	X	A
13	X	X	A	X	X	X	A
14	X	X	A	X	X	X	A
15	X	X	A	X	X	X	A
16	X	X	A	X	X	X	A
17	X	X	A	X	X	X	A
18	X	X	A	X	X	X	A
19	X	X	A	X	X	X	A
20	X	X	A	X	X	X	A
21	X	X	A	X	X	X	A
22	X	X	A	X	X	X	A
23	X	X	A	X	X	X	A
24	X	X	A	X	X	X	A
25	X	X	A	X	X	X	A
26	X	X	A	X	X	X	A
27	X	X	A	X	X	X	A
28	X	X	A	X	X	X	A
29	X	X	A	X	X	X	A
30	X	X	A	X	X	X	A
31	X	X	A	X	X	X	A
Total hours normal operation	744	744	0	744	744	744	0
% normal operation	100	100	100	100	100	100	100

Legend :

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

Table 2.2.1 (page 4 of 6)
NORSAR Communication Status Report
Month: January 1995

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	X	A	X	X	X	A
02	X	X	A	X	X	X	A
03	X	X	X	X	X	X	A
04	X	X	X	X	X	X	X
05	X	X	X	X	X	X	X
06	X	X	X	X	X	X	X
07	X	X	X	X	X	X	X
08	X	X	X	X	X	X	X
09	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X
11	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X
16	X	X	X	X	X	X	X
17	X	X	X	X	X	X	X
18	X	X	X	X	X	X	X
19	X	X	X	X	X	X	X
20	X	X	X	X	X	X	X
21	X	X	X	X	X	X	X
22	X	X	X	X	X	X	X
23	X	X	X	X	A	X	X
24	X	X	X	X	A	X	X
25	X	X	X	X	X	X	X
26	X	X	X	X	X	X	X
27	X	X	X	X	X	X	X
28	X	X	X	X	X	X	X
29	X	X	X	X	X	X	X
30	X	X	X	X	X	X	X
31	X	X	X	X	X	X	X
Total hours normal operation	744	744	696	744	696	744	672
% normal operation	100	100	94	100	94	100	90

Legend :

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

Table 2.2.1 (page 5 of 6)
NORSAR Communication Status Report
Month: February 1995

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	X	X	X	X	X	X
02	X	X	X	X	X	X	X
03	X	X	X	X	X	X	X
04	X	X	X	X	X	X	X
05	X	X	X	X	X	X	X
06	X	X	X	X	X	X	X
07	X	X	X	X	X	X	X
08	X	X	X	X	X	X	X
09	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X
11	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X
16	X	X	X	X	X	X	X
17	X	X	X	X	X	X	X
18	X	X	X	X	X	X	X
19	X	X	X	X	X	X	X
20	X	X	X	X	X	X	X
21	X	X	X	X	X	X	X
22	X	X	X	X	X	X	X
23	X	X	A	X	X	X	X
24	X	X	A	X	X	X	X
25	X	X	A	X	X	X	X
26	X	X	A	X	X	X	X
27	X	X	A	X	X	X	X
28	X	X	A	X	X	X	X
29							
30							
31							
Total hours normal operation	672	672	528	672	672	624	672
% normal operation	100	100	79	100	100	93	100

Legend :

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hour

Table 2.2.1 (page 6 of 6)
NORSAR Communication Status Report
Month: March 1995

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	X	X	X	X	X	X
02	X	X	X	X	X	X	X
03	X	X	X	X	X	X	X
04	X	X	X	X	X	X	X
05	X	X	X	X	X	X	X
06	X	X	X	X	X	X	X
07	X	X	X	X	X	X	X
08	X	X	X	X	X	A	X
09	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X
11	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X
16	X	X	X	X	X	X	X
17	X	X	X	X	X	X	X
18	X	X	X	X	X	X	X
19	X	X	X	X	X	X	X
20	X	X	X	X	X	X	X
21	X	X	X	X	X	X	X
22	X	X	X	X	X	X	X
23	X	X	X	X	X	X	X
24	X	X	X	X	X	X	X
25	X	X	X	X	X	X	X
26	X	X	X	X	X	X	X
27	X	X	X	X	X	X	X
28	X	X	X	X	X	X	X
29	X	X	X	X	X	X	X
30	X	X	X	X	X	X	X
31	X	X	X	X	X	X	X
Total hours normal operation	743	743	743	730	743	709	708
% normal operation	99.9	99.9	99.9	98.1	99.9	95.3	95.2

Legend :

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

2.3 NORSAR Event Detection operation

In Table 2.3.1 some monthly statistics of the Detection and Event Processor operation are given. The table lists the total number of detections (DPX) triggered by the on-line detector, the total number of detections processed by the automatic event processor (EPX) and the total number of events accepted after analyst review (teleseismic phases, core phases and total).

	Total DPX	Total EPX	Accepted events		Sum	Daily
			P-phases	Core Phases		
Oct 94	13238	1593	918	65	983	31.7
Nov 94	11420	936	229	40	269	9.0
Dec 94	11979	924	229	32	261	8.4
Jan 95	11972	755	253	59	312	10.1
Feb 95	10223	865	171	58	229	8.2
Mar 95	12259	704	210	51	261	8.4
			2010	305	2315	12.6

Table 2.3.1. Detection and Event Processor statistics, 1 October 1994 - 31 March 1995.

NORSAR Detections

The number of detections (phases) reported by the NORSAR detector during day 274, 1994, through day 090, 1995, was 81,342, giving an average of 447 detections per processed day (182 days processed). Table 2.3.2 shows daily and hourly distribution of detections for NORSAR.

B. Paulsen

NB2 .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
274	22	20	26	25	34	22	28	28	27	20	28	16	21	14	33	32	30	27	42	20	26	43	23	20	627	Oct 01 Saturday
275	26	31	22	30	16	32	17	24	17	12	35	17	8	14	17	18	30	21	13	19	30	33	35	20	537	Oct 02 Sunday
276	21	22	37	33	19	22	11	20	11	9	7	8	9	16	12	21	19	21	26	17	23	20	25	17	446	Oct 03 Monday
277	30	29	35	21	21	26	10	8	15	10	16	9	29	51	128	97	118	96	77	62	64	82	53	63	1150	Oct 04 Tuesday
278	57	57	62	71	59	47	30	31	29	37	29	23	45	25	32	23	42	31	31	26	36	40	35	33	931	Oct 05 Wednesday
279	40	35	25	28	37	37	35	36	12	28	28	23	54	22	20	28	20	22	38	16	30	41	19	39	713	Oct 06 Thursday
280	39	26	23	33	26	22	15	19	19	14	18	18	30	26	8	16	13	10	33	17	17	31	20	34	527	Oct 07 Friday
281	21	6	20	21	39	26	17	24	12	12	25	22	20	15	11	4	11	28	25	22	33	49	43	27	533	Oct 08 Saturday
282	27	17	28	29	33	20	20	15	36	35	21	34	25	19	27	29	24	21	17	30	24	16	29	29	605	Oct 09 Sunday
283	31	19	17	27	26	22	8	11	0	6	16	6	7	17	19	12	19	8	15	28	26	32	20	24	416	Oct 10 Monday
284	22	33	27	31	32	20	25	9	31	8	4	16	23	18	24	16	22	17	30	12	27	20	25	25	517	Oct 11 Tuesday
285	24	31	45	28	16	44	56	18	11	20	20	20	16	10	33	25	19	26	30	16	18	36	28	24	614	Oct 12 Wednesday
286	22	34	26	31	22	36	17	17	7	8	11	30	28	29	18	21	29	21	21	16	9	19	21	19	512	Oct 13 Thursday
287	35	25	15	22	22	17	7	16	6	14	22	8	25	3	15	24	9	14	14	20	28	11	18	25	415	Oct 14 Friday
288	14	16	20	10	12	23	18	22	19	14	21	18	28	12	23	24	25	21	18	25	25	24	28	0	460	Oct 15 Saturday
289	0	0	0	0	0	0	0	0	0	18	23	10	13	20	18	12	25	32	32	28	29	23	21	26	330	Oct 16 Sunday
290	25	31	34	24	36	21	7	7	16	17	14	6	5	6	18	13	18	16	13	21	11	17	14	23	413	Oct 17 Monday
291	15	28	27	18	14	10	6	3	12	20	16	35	32	12	15	18	19	20	26	15	18	16	21	33	449	Oct 18 Tuesday
292	19	21	25	18	21	23	8	24	8	4	7	20	15	20	14	19	8	16	37	17	26	17	27	17	431	Oct 19 Wednesday
293	22	30	29	41	30	14	9	9	13	25	17	9	26	24	26	19	12	13	17	24	19	16	12	28	484	Oct 20 Thursday
294	18	23	27	28	17	9	12	1	15	12	20	45	35	4	20	19	21	20	31	24	28	34	23	40	526	Oct 21 Friday
295	43	32	20	35	25	36	28	29	35	29	23	16	23	18	19	25	23	34	30	32	25	29	24	23	656	Oct 22 Saturday
296	26	24	33	43	41	25	20	21	27	30	25	23	23	21	21	11	18	21	16	22	25	42	30	25	613	Oct 23 Sunday
297	26	22	18	24	32	17	10	9	11	5	2	3	3	16	6	21	20	24	16	26	15	17	8	19	370	Oct 24 Monday
298	14	24	18	16	17	11	20	13	1	24	23	18	13	18	13	22	15	14	21	25	16	16	17	15	404	Oct 25 Tuesday
299	21	16	22	22	21	10	10	12	23	7	16	9	12	16	22	20	17	6	14	14	10	9	12	15	356	Oct 26 Wednesday
300	18	9	20	18	11	6	4	9	7	8	4	18	8	34	19	32	39	11	16	17	14	11	31	13	377	Oct 27 Thursday
301	18	24	31	11	18	15	3	13	13	11	8	20	23	23	102	74	106	20	8	18	16	24	22	15	636	Oct 28 Friday
302	33	10	16	12	24	18	6	17	16	9	8	13	8	6	18	6	31	9	17	15	23	15	10	12	352	Oct 29 Saturday
303	21	13	12	9	22	21	14	7	48	20	14	10	22	12	9	12	25	17	20	28	10	14	20	30	430	Oct 30 Sunday
304	26	11	23	37	36	20	19	5	14	14	19	8	27	17	34	33	27	51	34	15	19	13	23	36	561	Oct 31 Monday
305	28	24	24	29	31	19	12	50	22	14	40	38	30	17	37	18	14	17	13	14	25	18	19	17	570	Nov 01 Tuesday
306	21	36	25	25	45	29	26	22	25	24	23	25	28	31	36	12	12	29	26	24	29	35	25	18	631	Nov 02 Wednesday
307	28	18	20	18	12	16	4	35	11	13	32	27	34	14	20	12	7	18	18	11	38	13	14	28	461	Nov 03 Thursday
308	22	20	27	15	19	17	18	20	18	8	22	20	31	14	13	20	26	23	28	16	29	22	27	28	503	Nov 04 Friday
309	25	39	35	29	35	56	30	22	31	26	40	24	30	28	31	37	16	31	28	31	32	29	27	17	729	Nov 05 Saturday
310	14	28	18	19	29	26	41	16	17	23	23	20	16	11	29	16	26	36	25	26	19	18	23	30	549	Nov 06 Sunday
311	24	12	23	16	12	22	8	0	3	3	5	6	13	21	16	29	18	21	13	23	5	13	20	19	345	Nov 07 Monday
312	26	28	14	11	17	14	3	15	12	3	9	30	14	22	20	8	6	12	10	0	5	13	11	12	315	Nov 08 Tuesday
313	18	23	12	16	15	9	1	11	0	2	9	8	40	23	30	16	8	8	14	19	7	26	9	20	344	Nov 09 Wednesday
314	18	23	10	25	18	8	12	7	16	3	11	9	11	9	16	23	12	12	2	18	13	23	17	19	335	Nov 10 Thursday
315	24	22	25	22	17	25	7	11	6	11	34	30	33	20	28	9	21	12	11	19	18	25	23	24	477	Nov 11 Friday
316	28	39	17	29	28	20	20	19	16	21	16	17	26	28	14	23	23	16	26	30	28	23	19	8	534	Nov 12 Saturday
317	22	19	16	23	28	15	19	67	29	12	24	16	19	13	20	14	10	16	18	17	31	32	31	36	547	Nov 13 Sunday
318	23	36	34	15	22	25	19	29	12	8	12	16	12	17	23	25	24	26	17	25	21	27	29	30	527	Nov 14 Monday
319	34	26	26	13	16	26	17	10	18	13	17	31	12	14	20	18	12	17	15	23	47	20	22	21	488	Nov 15 Tuesday
320	24	21	24	26	25	19	7	13	11	3	11	25	20	13	16	24	10	14	12	17	10	12	9	20	386	Nov 16 Wednesday
321	20	16	22	14	8	15	15	16	6	10	11	16	42	9	20	23	8	11	9	17	14	12	18	13	365	Nov 17 Thursday
322	11	24	12	19	16	15	18	2	5	13	9	12	28	15	18	14	8	7	12	12	10	12	11	23	326	Nov 18 Friday
323	20	10	14	18	21	24	27	21	28	27	26	32	29	30	22	27	25	28	26	31	20	21	22	28	577	Nov 19 Saturday
324	20	30	30	38	27	34	20	29	32	37	16	17	21	27	33	24	25	29	42	29	37	35	24	31	687	Nov 20 Sunday
325	26	28	23	21	16	25	16	7	22	15	7	11	14	14	18	7	16	11	11	15	10	34	7	19	393	Nov 21 Monday
326	12	24	17	17	17	28	18	8	8	4	17	45	29	19	36	22	15	18	23	25	26	28	10	20	486	Nov 22 Tuesday
327	19	20	32	24	32	18	13	11	11	10	32	29	22	20	10	15	14	17	13	3	25	18	15	30	453	Nov 23 Wednesday
328	23	24	18	33	25	22	14	8	15	14	29	31	15	39	34	14	18	13	12	17	33	27	33	22	533	Nov 24 Thursday
329	26	28	20	26	20	25	5	15	12	28	9	15	8	34	24	12	10	13	20	21	15	29	16	23	454	Nov 25 Friday

Table 2.3.2 (Page 1 of 4)

NB2 .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
330	17	22	23	26	36	23	25	21	19	12	36	23	18	12	13	31	19	31	21	20	24	24	21	28	545	Nov 26 Saturday
331	17	28	33	37	20	24	37	33	33	13	23	24	13	14	18	21	21	22	27	30	18	22	19	19	566	Nov 27 Sunday
332	16	14	8	13	14	17	11	5	5	1	0	8	9	10	2	5	5	7	14	12	12	15	10	24	237	Nov 28 Monday
333	15	14	19	23	11	16	17	10	10	10	20	14	21	6	17	16	13	12	6	14	16	13	17	13	343	Nov 29 Tuesday
334	39	28	32	19	16	16	5	0	7	6	5	15	27	14	38	20	9	16	13	21	20	15	29	25	435	Nov 30 Wednesday
335	26	20	27	21	26	15	6	16	12	2	9	21	18	16	15	24	15	7	14	8	11	22	15	25	391	Dec 01 Thursday
336	29	19	13	19	19	19	16	15	21	4	24	24	16	19	28	11	21	21	31	32	18	24	24	27	494	Dec 02 Friday
337	32	39	25	12	18	18	24	12	11	10	15	16	18	15	26	23	12	24	16	22	29	16	24	26	483	Dec 03 Saturday
338	26	31	36	26	22	25	20	30	32	26	16	10	21	21	31	27	14	23	17	19	19	13	27	26	558	Dec 04 Sunday
339	23	21	22	21	18	17	9	14	3	8	14	2	17	6	12	6	17	9	9	15	16	15	11	17	322	Dec 05 Monday
340	34	29	18	25	22	22	12	13	35	11	23	9	32	26	20	22	17	28	30	31	16	25	25	25	550	Dec 06 Tuesday
341	23	32	19	25	20	23	16	6	4	12	45	16	40	37	23	17	10	12	20	25	24	20	30	23	522	Dec 07 Wednesday
342	24	23	20	35	21	12	12	9	18	8	28	22	20	19	13	19	14	6	12	10	18	17	19	27	426	Dec 08 Thursday
343	23	38	26	26	20	20	27	27	25	27	15	14	29	27	10	15	23	28	20	23	34	33	29	15	574	Dec 09 Friday
344	20	23	34	20	30	20	21	29	27	28	24	18	23	23	18	29	31	14	23	20	18	42	28	16	579	Dec 10 Saturday
345	25	38	25	24	31	33	25	22	28	31	28	12	21	28	22	21	15	29	15	29	25	24	22	17	590	Dec 11 Sunday
346	17	32	30	23	19	24	7	12	12	19	19	43	34	19	10	31	20	17	10	22	15	10	8	12	465	Dec 12 Monday
347	16	26	17	24	20	23	11	10	17	14	18	20	35	30	18	11	5	24	12	18	23	28	19	29	468	Dec 13 Tuesday
348	20	25	32	20	28	14	14	17	11	12	15	7	29	12	4	12	12	14	17	5	24	12	9	21	386	Dec 14 Wednesday
349	14	23	12	18	33	18	11	11	18	12	19	27	13	10	32	11	15	14	12	16	19	18	14	24	414	Dec 15 Thursday
350	16	18	21	21	24	22	19	16	13	6	13	11	36	14	22	19	11	23	18	18	30	14	22	17	444	Dec 16 Friday
351	25	11	26	19	15	12	23	33	9	19	12	12	10	19	20	21	22	24	18	17	21	34	23	24	469	Dec 17 Saturday
352	28	21	30	19	19	27	18	20	12	15	20	29	26	19	20	19	14	23	17	23	22	13	18	16	488	Dec 18 Sunday
353	26	20	24	23	34	21	7	10	21	12	12	13	5	16	28	35	18	30	17	25	16	32	17	30	492	Dec 19 Monday
354	19	19	27	16	23	29	19	13	14	12	12	24	10	37	17	3	15	7	8	12	14	12	13	15	390	Dec 20 Tuesday
355	11	21	15	30	23	12	14	10	24	6	19	26	62	51	19	17	9	15	15	17	21	8	11	17	473	Dec 21 Wednesday
356	14	18	9	8	20	7	14	15	12	6	15	16	6	29	23	14	17	13	13	11	16	9	10	13	328	Dec 22 Thursday
357	21	14	13	14	11	20	13	18	0	0	0	0	9	4	0	0	3	0	4	0	0	2	0	0	146	Dec 23 Friday
358	4	0	0	0	0	1	0	0	0	1	0	0	5	0	3	1	0	0	0	0	6	0	1	2	24	Dec 24 Saturday
359	1	5	1	0	8	0	0	0	18	26	21	26	22	24	17	21	16	19	20	22	17	32	32	33	381	Dec 25 Sunday
360	27	18	24	29	33	24	17	32	21	25	30	18	17	25	33	17	16	31	18	13	24	28	16	22	558	Dec 26 Monday
361	13	21	17	19	16	19	18	19	22	24	19	16	20	32	24	20	21	32	21	25	23	12	14	22	489	Dec 27 Tuesday
362	30	20	24	25	26	24	14	18	18	12	13	19	59	50	25	31	30	30	29	21	28	31	35	27	639	Dec 28 Wednesday
363	21	25	15	14	19	27	18	9	16	22	14	14	35	14	11	23	19	17	17	25	16	27	30	16	464	Dec 29 Thursday
364	25	17	17	28	23	17	17	23	15	13	15	31	41	15	28	35	19	22	19	17	17	16	8	25	503	Dec 30 Friday
365	26	19	11	29	20	24	24	20	18	16	20	11	18	22	30	20	24	29	20	28	28	29	22	22	530	Dec 31 Saturday
1	19	18	24	19	13	10	19	30	21	12	8	17	15	8	5	15	9	4	14	4	12	8	16	23	343	Jan 01 Sunday
2	17	10	13	12	11	8	9	9	6	8	7	6	12	13	7	13	18	17	19	16	17	38	14	19	319	Jan 02 Monday
3	25	18	15	16	19	18	19	20	7	2	7	13	15	13	16	14	16	13	17	13	18	10	19	24	367	Jan 03 Tuesday
4	20	24	18	13	23	19	10	18	10	10	8	10	12	9	10	18	8	11	12	10	16	13	16	20	338	Jan 04 Wednesday
5	18	19	11	16	17	18	7	7	5	17	7	8	33	15	9	7	7	6	4	7	10	33	0	6	287	Jan 05 Thursday
6	14	11	19	16	19	12	14	13	7	13	13	10	27	10	13	18	16	10	21	25	20	17	29	23	390	Jan 06 Friday
7	14	20	31	24	19	18	18	18	13	16	25	14	17	24	26	17	31	16	20	16	23	29	21	24	494	Jan 07 Saturday
8	20	24	21	13	29	16	33	21	17	31	27	21	23	19	25	14	11	12	17	27	16	17	11	18	483	Jan 08 Sunday
9	15	21	17	19	24	19	24	16	24	14	10	17	18	13	30	13	9	10	18	20	24	26	23	18	442	Jan 09 Monday
10	23	25	21	9	10	8	7	13	18	11	16	20	17	15	12	13	11	14	15	19	24	12	15	15	363	Jan 10 Tuesday
11	22	7	14	36	12	11	12	18	20	8	17	6	26	9	18	21	10	5	7	12	15	10	14	23	353	Jan 11 Wednesday
12	17	20	18	15	14	12	16	15	13	10	18	17	13	13	15	13	14	20	12	11	13	14	23	25	371	Jan 12 Thursday
13	14	25	21	24	27	20	16	26	14	19	18	11	19	14	16	22	17	34	16	20	23	16	11	12	455	Jan 13 Friday
14	29	17	21	16	11	24	16	21	24	29	13	17	38	18	27	23	9	25	15	27	19	27	17	26	509	Jan 14 Saturday
15	22	29	26	22	31	25	32	23	18	24	20	18	18	14	17	14	15	20	19	25	23	13	15	9	492	Jan 15 Sunday
16	21	12	16	18	22	16	16	22	9	10	9	6	11	20	18	14	17	9	29	11	18	19	21	20	384	Jan 16 Monday
17	13	17	20	22	24	16	14	9	8	10	14	12	9	18	20	16	16	27	10	28	15	13	19	25	395	Jan 17 Tuesday
18	29	19	18	22	16	20	5	11	7	7	18	9	17	11	16	12	17	15	17	19	26	18	11	24	384	Jan 18 Wednesday
19	20	21	23	27	15	13	20	18	14	15	16	31	8	20	24	31	14	9	21	22	13	19	23	17	454	Jan 19 Thursday
20	26	21	15	20	14	13	5	15	14	15	5	19	22	13	24	16	27	19	18	18	18	15	23	11	406	Jan 20 Friday

Table 2.3.2. (Page 2 of 4)

NB2 .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
21	21	19	22	26	18	14	13	38	26	22	19	13	25	16	12	16	17	12	13	13	8	17	17	15	432	Jan 21 Saturday
22	13	11	14	22	23	22	11	27	23	21	17	21	26	18	19	13	14	15	18	24	17	23	19	27	458	Jan 22 Sunday
23	20	23	22	12	12	19	19	8	7	9	12	9	13	22	16	19	9	14	6	7	24	16	23	18	359	Jan 23 Monday
24	20	21	33	21	20	12	8	18	12	15	9	8	36	20	15	20	19	8	29	26	22	29	25	32	478	Jan 24 Tuesday
25	27	35	36	22	29	14	26	12	18	15	23	10	20	10	14	20	14	6	19	22	20	24	5	17	458	Jan 25 Wednesday
26	20	16	12	22	16	14	3	11	7	9	6	15	12	2	11	8	6	10	8	13	7	12	18	16	274	Jan 26 Thursday
27	13	21	22	12	18	13	11	14	12	7	11	22	15	13	15	10	21	10	21	14	32	17	22	15	381	Jan 27 Friday
28	11	13	13	10	12	8	18	15	16	23	29	19	11	15	15	6	17	21	12	15	23	20	9	13	364	Jan 28 Saturday
29	13	22	20	20	26	23	10	18	13	18	24	16	26	14	17	11	16	19	13	32	33	20	19	11	454	Jan 29 Sunday
30	15	13	12	22	17	17	13	18	77	34	31	38	43	63	40	15	23	10	19	20	12	11	22	26	611	Jan 30 Monday
31	32	29	22	30	24	17	6	8	15	5	3	6	9	4	3	4	3	6	11	17	12	17	15	19	317	Jan 31 Tuesday
32	25	11	21	19	17	16	13	9	60	59	56	56	22	35	51	55	16	7	9	8	14	14	15	16	624	Feb 01 Wednesday
33	11	11	10	23	11	7	13	15	19	3	7	16	11	17	26	19	11	13	17	24	24	30	24	18	380	Feb 02 Thursday
34	31	28	32	25	26	27	19	10	14	14	8	10	24	15	20	22	23	19	24	13	22	15	17	17	475	Feb 03 Friday
35	27	11	15	12	8	7	13	9	3	6	7	4	2	4	5	6	2	8	4	3	4	8	11	10	189	Feb 04 Saturday
36	8	8	11	8	8	11	10	17	11	23	20	18	17	17	23	4	6	8	6	12	18	12	8	24	308	Feb 05 Sunday
37	21	8	1	8	7	4	3	3	67	56	84	39	69	37	34	39	14	18	10	22	18	22	19	17	620	Feb 06 Monday
38	23	36	28	23	20	24	14	15	16	7	9	11	24	17	17	20	15	23	13	13	21	28	23	18	458	Feb 07 Tuesday
39	34	27	26	28	22	22	12	16	22	12	15	8	14	17	14	15	20	16	14	10	12	22	13	23	434	Feb 08 Wednesday
40	16	19	20	29	18	17	18	21	4	25	25	38	12	10	15	21	13	17	20	13	17	23	19	12	442	Feb 09 Thursday
41	17	23	22	21	17	17	18	13	12	8	16	16	27	21	6	12	26	14	21	18	19	14	30	6	414	Feb 10 Friday
42	8	18	16	19	17	24	21	28	13	10	14	11	19	10	17	20	18	25	23	33	20	16	16	21	437	Feb 11 Saturday
43	18	27	17	37	20	28	17	25	27	12	16	18	17	18	14	27	18	18	17	23	36	30	27	24	531	Feb 12 Sunday
44	24	27	24	27	19	18	7	14	21	26	44	5	22	24	14	25	20	14	19	15	23	15	19	17	483	Feb 13 Monday
45	9	23	22	24	13	22	8	10	10	4	7	11	10	10	9	7	10	15	15	10	21	9	6	16	301	Feb 14 Tuesday
46	26	29	28	19	12	14	15	6	4	11	26	9	11	28	10	14	16	16	7	9	12	15	16	24	377	Feb 15 Wednesday
47	13	21	16	20	18	21	10	7	12	7	40	8	12	14	28	18	9	9	14	13	12	14	7	14	357	Feb 16 Thursday
48	14	19	16	10	11	9	17	10	14	8	9	21	28	27	18	20	13	17	13	30	22	9	12	10	377	Feb 17 Friday
49	31	14	22	21	25	12	18	5	6	7	4	5	7	10	10	2	6	3	7	11	14	12	9	19	280	Feb 18 Saturday
50	28	25	20	17	28	22	26	11	9	14	18	16	16	15	11	15	15	13	19	18	25	9	22	16	428	Feb 19 Sunday
51	14	21	19	18	20	11	11	8	10	5	4	5	32	6	4	9	18	8	10	13	19	11	14	15	305	Feb 20 Monday
52	21	11	26	13	21	11	8	1	8	3	6	9	13	6	13	3	10	9	3	3	7	11	3	21	240	Feb 21 Tuesday
53	13	4	9	14	20	12	15	10	8	12	20	9	15	20	22	21	22	16	16	17	27	12	8	12	354	Feb 22 Wednesday
54	13	10	10	6	9	33	15	12	9	12	9	15	22	18	15	16	13	7	12	14	17	24	16	9	336	Feb 23 Thursday
55	15	16	17	14	17	25	7	5	37	5	19	17	14	5	10	16	10	6	16	12	13	16	7	11	330	Feb 24 Friday
56	11	12	19	19	17	9	17	17	8	17	6	23	41	12	15	20	34	17	9	16	13	11	18	10	391	Feb 25 Saturday
57	25	18	24	26	20	17	21	11	16	14	18	17	9	11	7	20	17	15	12	14	13	18	15	17	395	Feb 26 Sunday
58	11	20	16	18	15	7	10	7	3	11	9	5	17	11	12	10	9	6	4	16	11	15	17	12	272	Feb 27 Monday
59	25	22	18	25	14	16	2	18	6	5	15	9	7	8	13	7	11	10	18	13	19	17	18	15	331	Feb 28 Tuesday
60	12	24	21	21	13	14	11	8	5	19	8	12	16	14	12	12	11	19	19	14	19	21	22	34	381	Mar 01 Wednesday
61	25	18	30	18	11	17	21	17	7	13	14	7	14	7	2	4	29	6	7	15	21	14	10	23	350	Mar 02 Thursday
62	16	13	10	11	10	11	11	13	5	12	14	13	24	18	2	9	15	8	12	8	8	15	19	9	286	Mar 03 Friday
63	13	16	15	21	25	21	16	14	13	11	29	13	10	23	11	16	15	8	22	11	23	19	11	-8	384	Mar 04 Saturday
64	12	20	12	15	21	15	7	19	19	35	16	28	17	22	18	17	15	22	18	15	23	23	24	22	455	Mar 05 Sunday
65	25	29	30	18	21	14	24	6	10	40	30	13	11	5	6	5	12	5	12	15	7	10	11	12	371	Mar 06 Monday
66	18	12	15	14	28	17	12	8	9	9	14	16	9	15	5	18	7	13	12	12	20	22	12	20	337	Mar 07 Tuesday
67	21	17	22	31	17	15	13	10	12	13	34	4	25	13	41	10	12	14	17	7	16	15	15	26	420	Mar 08 Wednesday
68	27	17	18	29	20	12	11	13	10	12	15	3	13	12	12	24	10	18	26	20	20	22	6	23	393	Mar 09 Thursday
69	12	19	14	24	19	32	13	4	13	11	12	18	10	14	21	30	11	16	22	15	26	21	22	18	417	Mar 10 Friday
70	20	26	31	26	21	22	24	16	41	16	25	22	16	16	20	25	17	25	19	17	29	33	18	27	552	Mar 11 Saturday
71	26	30	27	27	33	35	24	25	25	19	24	20	23	31	25	18	18	26	16	18	15	19	21	15	560	Mar 12 Sunday
72	19	8	31	14	25	13	8	9	19	7	19	8	22	8	10	7	7	10	16	15	15	21	18	40	369	Mar 13 Monday
73	24	17	17	25	21	18	22	16	13	16	14	8	21	20	25	17	19	17	23	18	12	20	15	17	435	Mar 14 Tuesday
74	19	18	25	10	22	20	11	10	10	18	43	23	21	19	21	20	14	12	13	18	18	20	16	17	438	Mar 15 Wednesday
75	11	22	23	24	22	13	20	9	21	18	13	17	18	11	12	19	16	13	18	24	16	18	27	11	416	Mar 16 Thursday
76	13	18	21	27	15	12	13	14	25	7	19	12	31	12	14	21	15	11	14	19	13	28	21	37	432	Mar 17 Friday

Table 2.3.2. (Page 3 of 4)

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NB2 .FKX Hourly distribution of detections

Day  00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23  Sum Date

 77  22 18 17 18 18 35 11 17 14 24 16 17 15 15 31 21 26 20 29 20 27 30 28 22  511 Mar 18 Saturday
 78  24 25 23 28 26 17 34 20 19 17 21 28 10 12 14 18 16 24 16 18 23 24 27 24  508 Mar 19 Sunday
 79  40 22 29 25 18 15 16 12 12  8 12  8  6 13 15 12 13 29 16 19 17 18 17 21  413 Mar 20 Monday
 80  16 21 24 19 11  8  9 24  7  5 11 21 16 10  9 14 14  4 15 20 18 19 10 20  345 Mar 21 Tuesday
 81  24 23 28 29 25 28 21  8  7 15  8 11 21  9 14 14 13 19 18 18 18 13 27 20  431 Mar 22 Wednesday
 82  19 27 31 26 17 24 13  8 14 18 25 24 18  9 20  7 15 13 11 14 16 16 28 23  436 Mar 23 Thursday
 83  11 25 22 14 19 11 10 16  9 14 14 11 24 13  3 14 14 15 26 14 29 18 14 17  377 Mar 24 Friday
 84  29 22 32 25 36 19 25 16 18 20 27 20 12  8  8  5 17  9 18 24 27 20 18 33  488 Mar 25 Saturday
 85  21 23 23 12 15 39 14  0 16 26 30 28 27 20 20 17 18 16 15 17 11  8 15 14  445 Mar 26 Sunday
 86   9  8 21  9 13 15  9 17 13  9  6 15  8  5 20 14 14 14 20 15 16 19 24 24  337 Mar 27 Monday
 87  27 26 30 27 23 19 14 11  9  9  7 22 23 17 12  9 13 12 26 19 18 13 15 12  413 Mar 28 Tuesday
 88  12 13 26 30 23  9  7  8 11  7 11 18 22 29 17 17 20 12 14 13 17  9 33 10  388 Mar 29 Wednesday
 89  15 15 28  9  6  4  4  6  2 40 14 24 15 13 25 25 13 22 16 19 19 23 25 15  397 Mar 30 Thursday
 90  19 26 25 22 19 17 17 13 13 19  7 17 22 16 21 17 23 23 26 23 24 19 21 29  478 Mar 31 Friday

NB2  00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Sum    3882   3892   3435   2772   2700   3094   3187   3315   3116   3331   3710   3756
   3845   3939   3770   2747   2855   3212   3764   3547   3151   3242   3624   3456    81342 Total sum

182  21 21 22 21 21 19 15 15 16 15 18 17 21 18 19 18 17 17 18 18 20 20 19 21  447 Total average

129  21 22 22 21 20 18 13 13 14 13 16 17 21 18 20 18 17 16 17 17 19 19 18 21  431 Average workdays

 53  21 20 21 21 22 21 19 20 20 20 20 18 19 17 19 18 18 20 19 21 22 22 21 20  480 Average weekends
```

Table 2.3.2. Daily and hourly distribution of NORSAR detections. For each day is shown number of detections within each hour of the day and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day. (Page 4 of 4)

3 Operation of Regional Arrays

3.1 Recording of NORESS data at NDPC, Kjeller

Table 3.1.1 lists the main outage times and reasons.

The average recording time was 99.17% as compared to 94.37% during the previous reporting period.

Date	Time	Cause
29 Oct	0133 - 1210	Hardware/software failure
03 Nov	1058 - 1250	Software work
21 Nov	1552 - 2200	Hardware/software failure
24 Nov	0908 - 1127	Power break Hub
24 Nov	1141 - 1216	Power break Hub
22 Dec	1000 - 1016	Hardware/software failure
31 Dec	2311 - 2400	Clock failure
19 Jan 95	0924 - 1150	Power break Hub
16 Feb	2211 - 2308	Transmission line failure
01 Mar	1309 - 1334	Hardware failure

Table 3.1.1. Interruptions in recording of NORESS data at NDPC, 1 October 1994 - 31 March 1995.

Monthly uptimes for the NORESS on-line data recording task, taking into account all factors (field installations, transmissions line, data center operation) affecting this task were as follows:

October 94	:	97.41
November	:	98.42
December	:	99.84
January 95	:	99.67
February	:	99.79
March	:	99.86

Fig. 3.1.1 shows the uptime for the data recording task, or equivalently, the availability of NORESS data in our tape archive, on a day-by-day basis, for the reporting period.

J. Torstveit

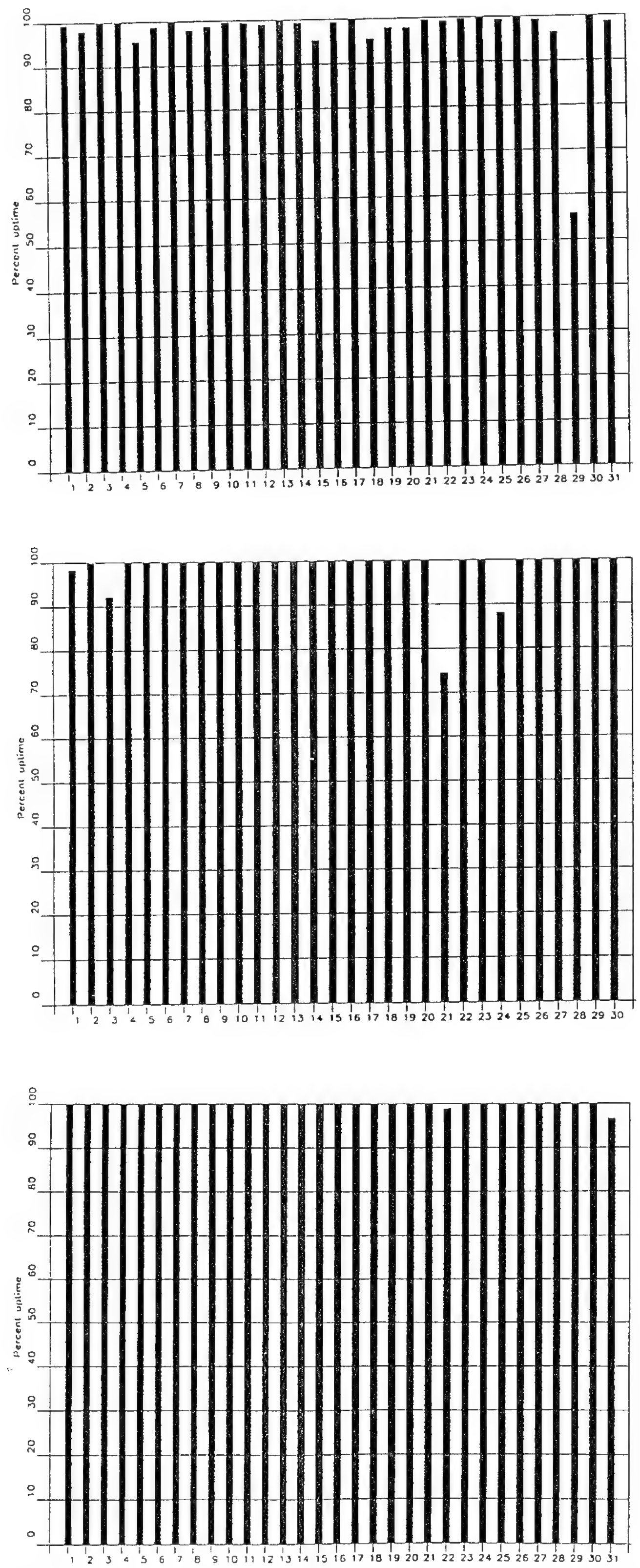

Fig. 3.1.1. NORESS data recording uptime for October (top), November (middle) and December (bottom) 1994.

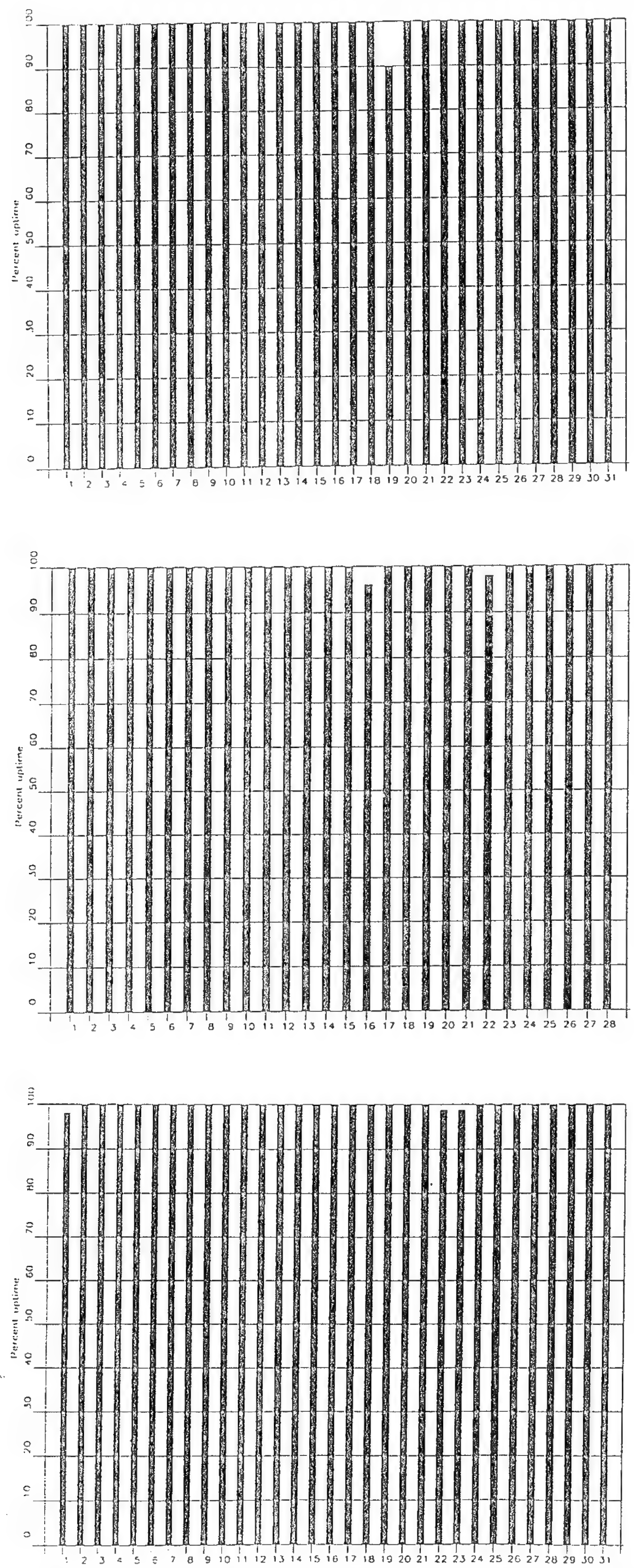

Fig. 3.1.1. (cont.) NORESS data recording uptime for January (top), February (middle) and March (bottom) 1995.

3.2 Recording of ARCESS data at NDPC, Kjeller

Table 3.2.1 lists the main outage times and reasons.

The average recording time was 99.37% as compared to 98.71% for the previous reporting period.

Date	Time	Cause
05 Oct	0807 - 1101	Transmission line failure
08 Nov	0702 - 1555	Problems at Hub
12 Dec	1252 - 1521	Problems at Hub
14 Dec	1100 - 1319	Software work
16 Dec	0825 - 1432	Problems at Hub
30 Jan 95	1134 - 1306	Power break at Hub
22 Feb	1724 - 1820	Clock failure
03 Mar	0918 - 1136	Power break Hub

Table 3.2.1. The main interruptions in recording of ARCESS data at NDPC, 1 October 1994 - 31 March 1995.

Monthly uptimes for the ARCESS on-line data recording task, taking into account all factors (field installations, transmissions line, data center operation) affecting this task were as follows:

October 94	:	99.59%
November	:	98.77%
December	:	98.52%
January 95	:	99.77%
February	:	99.85%
March	:	99.69%

Fig. 3.2.1. shows the uptime for the data recording task, or equivalently, the availability of ARCESS data in our tape archive, on a day-by-day basis, for the reporting period.

J. Torstveit

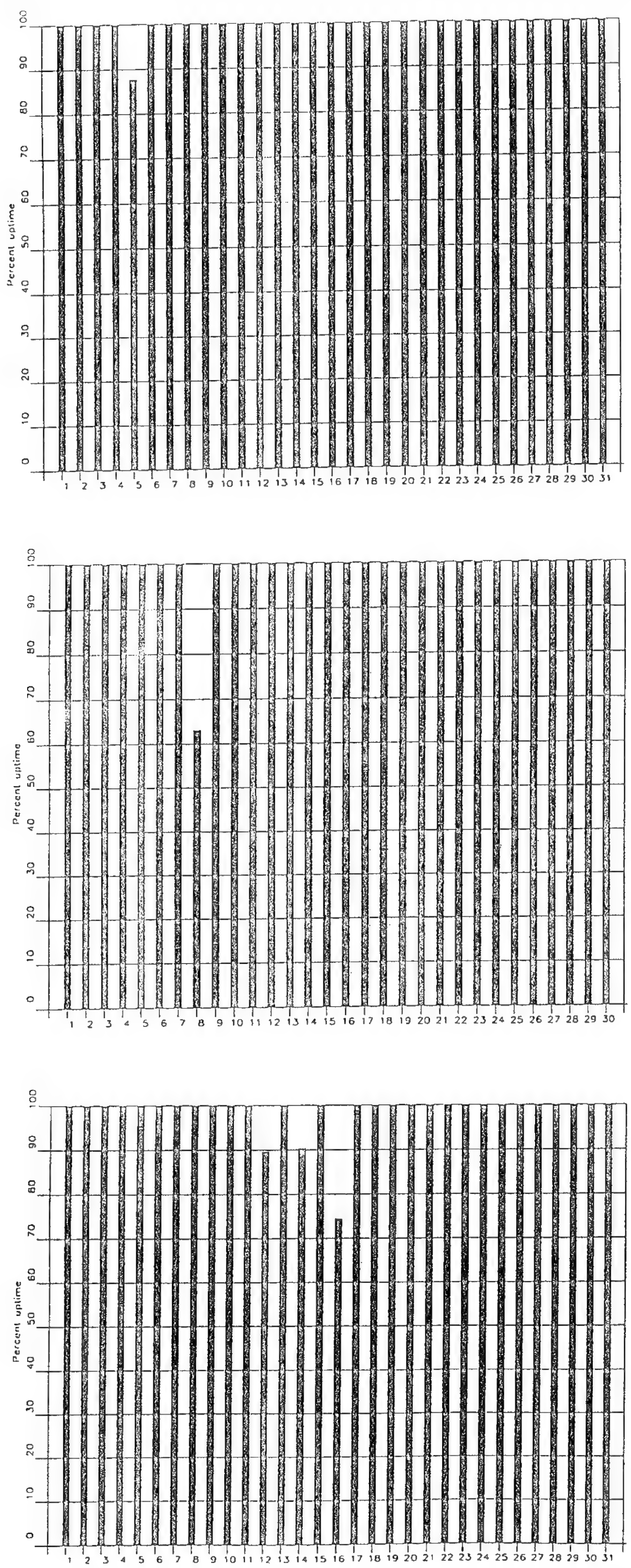

Fig. 3.2.1. ARCESS data recording uptime for October (top), November (middle) and December (bottom) 1994.

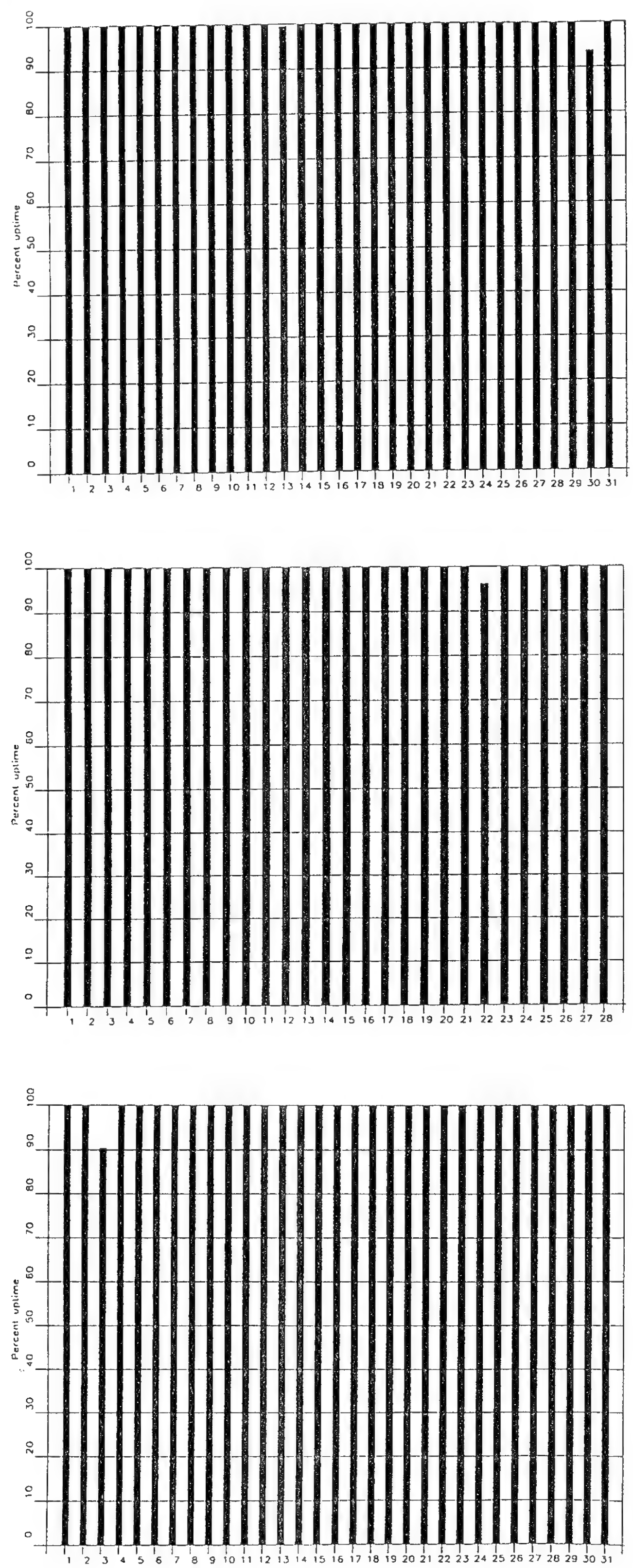

Fig. 3.2.1. ARCESS data recording uptime for January (top), February (middle) and March (bottom) 1995.

3.3 Recording of FINESS data at NDPC, Kjeller

The average recording time was 97.8%.

Date	Time			Cause
15 Oct	2252	-	2340	Line down due to power break
27 Oct	1038	-	1103	Field work
31 Oct	0813	-	0923	Power failure Helsinki
01 Nov	0419	-	0652	Software failure/work
05 Nov	2300	-		Problems in field
06Nov		-	1404	
08 Nov	0806	-	0835	Installation of UPS in Helsinki
13 Nov	0100	-	0524	Stop in Helsinki
22 Nov	0656	-	0825	Software work Helsinki
23 Nov	0632	-	0654	Software work Helsinki
01 Dec	2054	-	2125	Stop in Helsinki
06 Dec	1347	-	1420	Stop in Helsinki
11 Dec	0642	-	0710	Stop in Helsinki
12 Dec	1658	-	2006	Stop in Helsinki
17 Dec	0003	-	1210	Stop in Helsinki
17 Dec	1227	-	1244	Stop in Helsinki
17 Dec	2325	-		Stop in Helsinki
18 Dec		-	0033	
21 Dec	2124	-		Hardware failure Helsinki
22 Dec		-	0656	
26 Dec	2020	-	2326	Stop in Helsinki
31 Dec	1548	-	1620	Stop in Helsinki
10 Jan	0129	-	0152	Stop in Helsinki
14 Jan	1813	-	1840	Stop in Helsinki
19 Jan	1102	-	1132	Stop in Helsinki
24 Jan	0354	-	0427	Stop in Helsinki
26 Jan	1730	-	1818	Stop in Helsinki
31 Jan	1040	-	1453	Stop in Helsinki
07 Feb	0559	-	0625	Stop in Helsinki
11 Feb	2246	-	2312	Stop in Helsinki
21 Feb	0736	-	0802	Stop in Helsinki

Date	Time			Cause
26 Feb	0736	-	0802	Stop in Helsinki
03 Mar	0024	-	0049	Stop in Helsinki
18 Mar	1839	-		Power failure in Helsinki
19 Mar		-	2108	

Table 3.3.1. The main interruptions in recording of FINESS data at NDPC, 1 October 1994 - 31 March 1995.

Monthly uptimes for the FINESS on-line data recording task, taking into account all factors (field installations, transmission lines, data center operation) affecting this task were as follows:

October 94	:	99.67%
November	:	96.49%
December	:	95.59%
January 95	:	99.02%
February	:	99.76%
March	:	96.28%

Fig. 3.3.1 shows the uptime for the data recording task, or equivalently, the availability of FINESS data in our tape archive, on a day-by-day basis, for the reporting period.

J. Torstveit

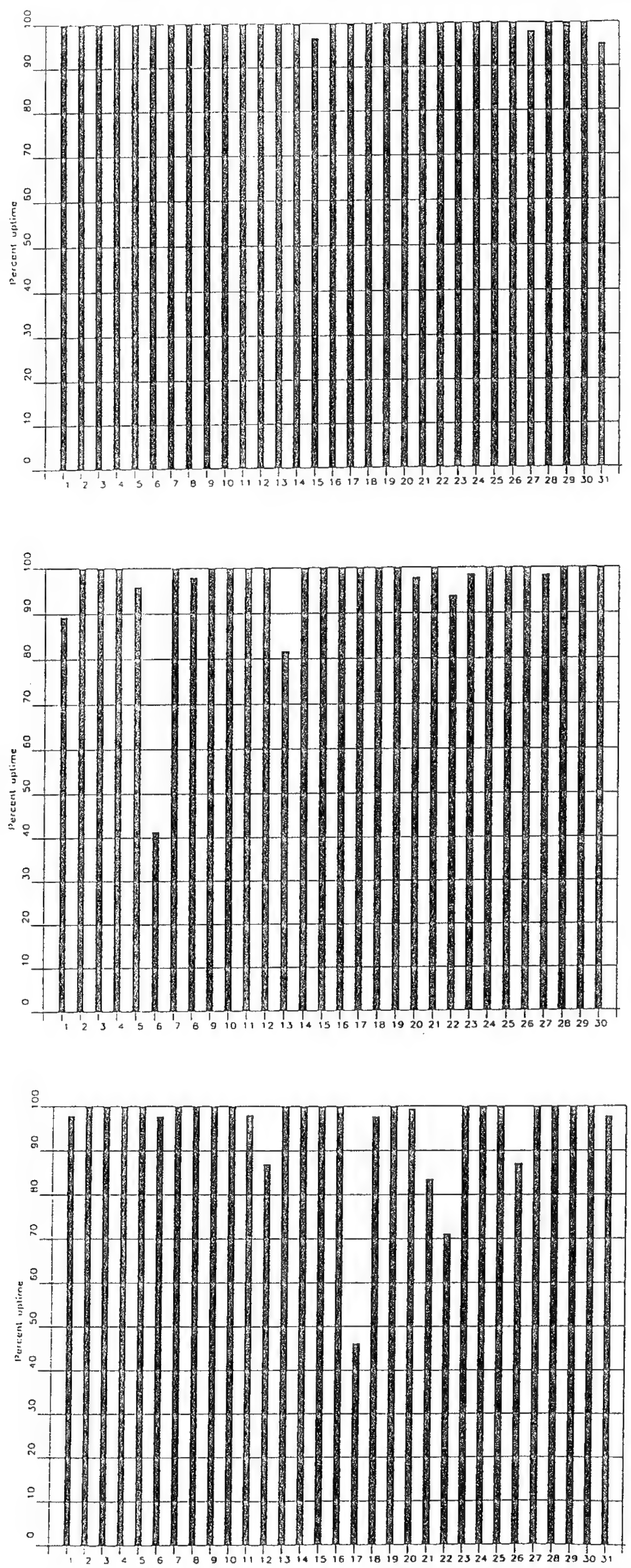

Fig. 3.3.1. FINESS data recording uptime for October (top), November (middle) and December (bottom) 1994.

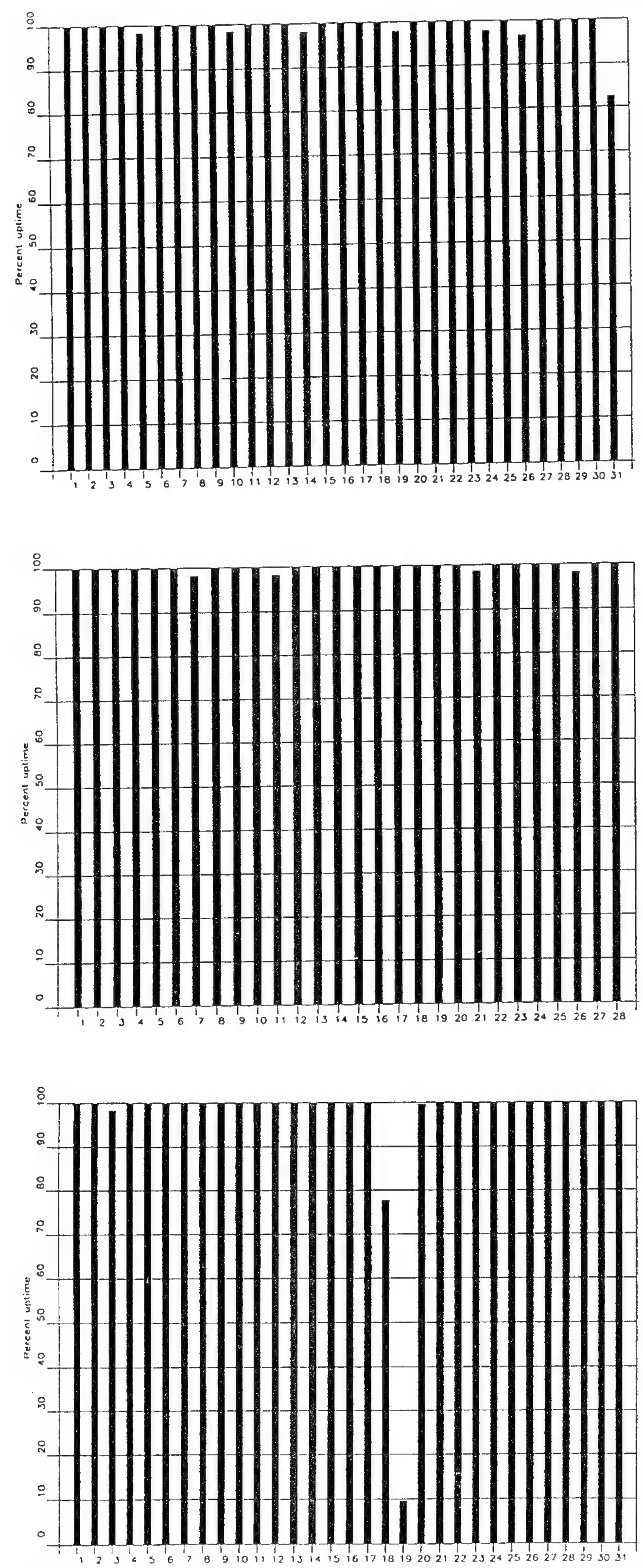

Fig. 3.3.1. **FINESS** data recording uptime for January (top), February (middle) and March (bottom) 1995.

3.4 Recording of Spitsbergen data at NDPC, Kjeller

The average recording time was 96.80% as compared to 91.8% for the previous reporting period.

The main reasons for downtime follow:

Date	Time			Cause
10 Oct	0604	-		Communication line failure
11 Oct		-	0900	
11 Oct	1252	-	1418	Communication line failure
11 Oct	2056	-	2124	Communication line failure
12 Oct	1152	-	1435	Communication line failure
18 Oct	1023	-	1158	Communication line failure
18 Oct	1536	-	2006	Communication line failure
18 Oct	2108	-	2245	Communication line failure
30 Oct	2021	-		Hardware failure NDPC
31 Oct		-	0712	
14 Nov	0520	-		Power failure Spitsbergen
16 Nov		-	1835	
04 Jan 95	0648	-	0723	Communication line failure
16 Feb	2211	-	2251	Communication line failure
30 Mar	1802	-	2255	Power failure Spitsbergen
31 Mar	0054	-	2400	Power failure Spitsbergen

Table 3.4.1. The main interruptions in recording of Spitsbergen data at NDPC, 1 October 1994 - 31 March 1995.

Monthly uptimes for the Spitsbergen online data recording task, taking into account all factors (field installations, transmission line, data center operation) affecting this task were as follows:

October 94	:	93.17%
November	:	91.60%
December	:	99.99%
January 95	:	99.93%
February	:	99.86%
March	:	96.27%

Fig. 3.4.1 shows the uptime for the data recording task, or equivalently, the availability of Spitsbergen data in our tape archive, on a day-by-day basis for the reporting period.

J. Torstveit

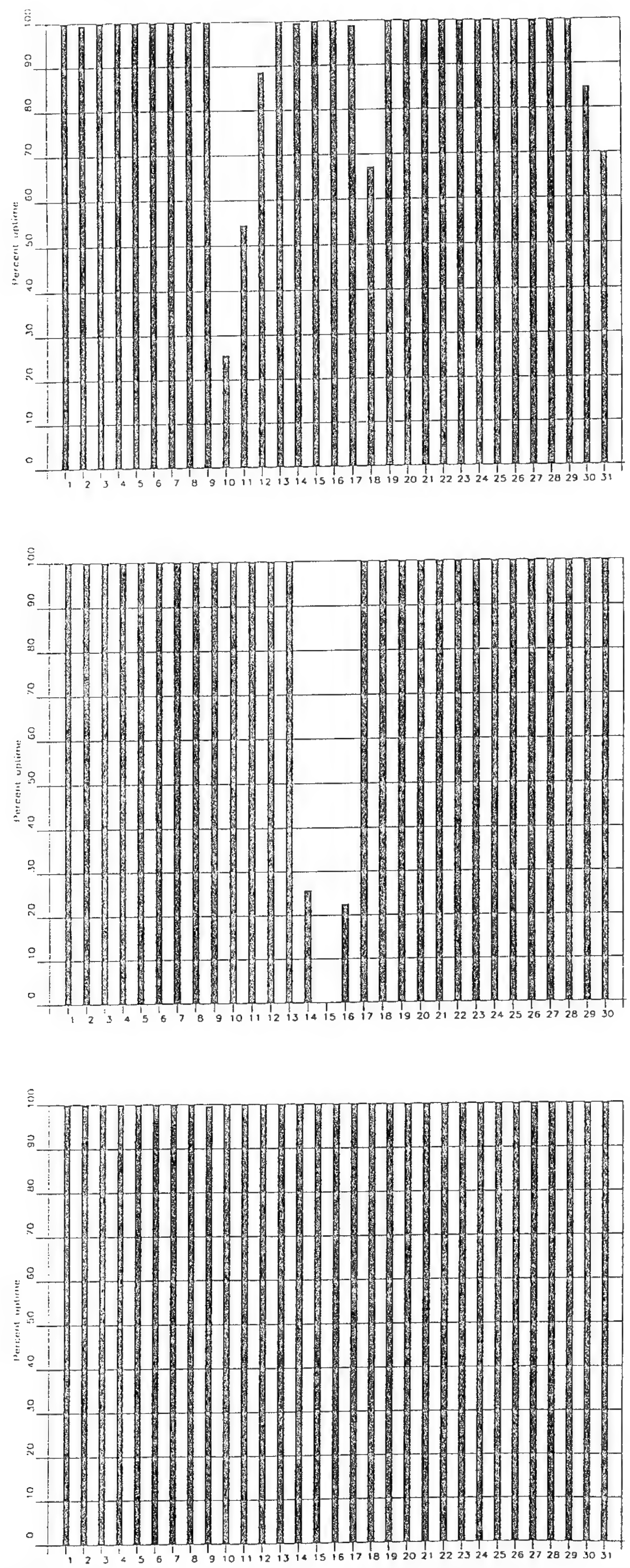

Fig. 3.4.1. Spitsbergen data recording uptime for October (top), November (middle) and December (bottom) 1994.

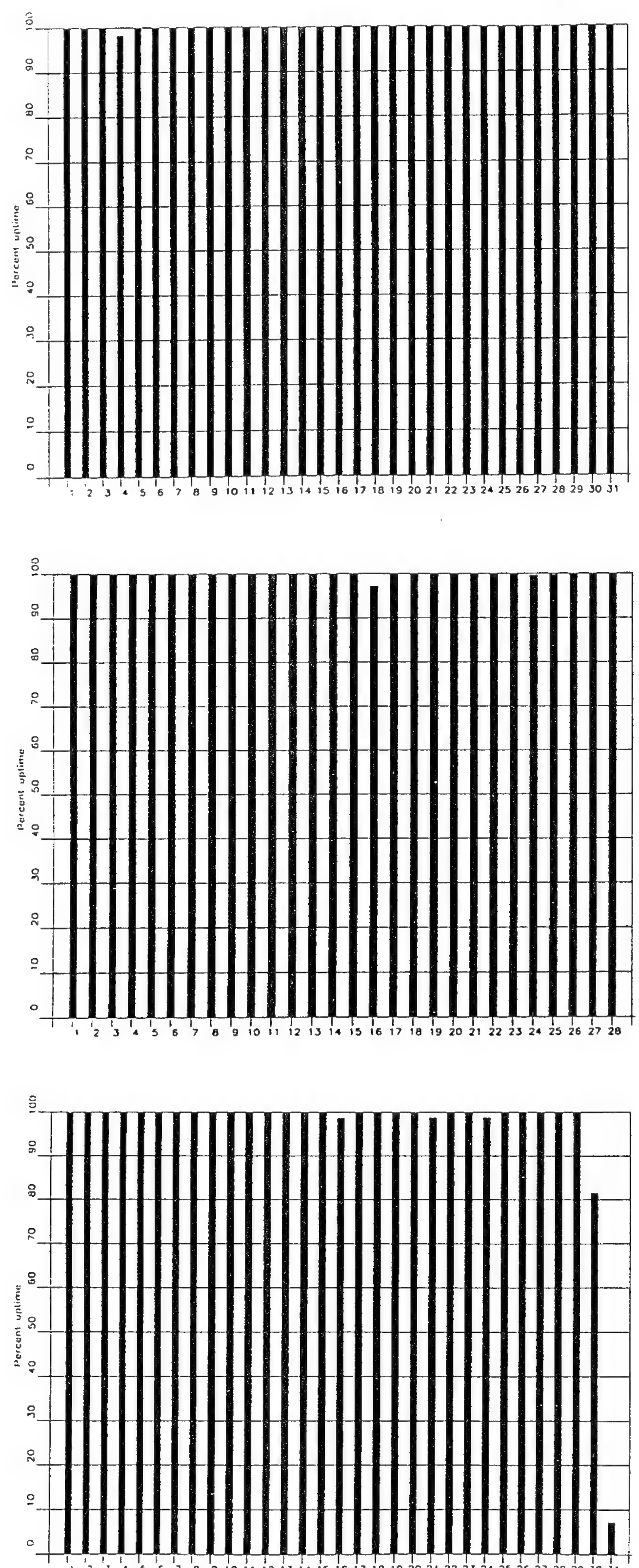

Fig. 3.4.1. Spitsbergen data recording uptime for January (top), February (middle) and March (bottom) 1995.

3.5 Event detection operation

This section reports results from one-array automatic processing using signal processing recipes and "ronapp" recipes for the ep program (NORSAR Sci. Rep. No 2-88/89).

Three systems are in parallel operation to associate detected phases and locate events:

1. The ep program with "ronapp" recipes is operated independently on each array to obtain simple one-array automatic solutions.
2. The Generalized Beamforming method (GBF) (see F. Ringdal and T. Kværna (1989), A mulitchannel processing approach to real time network detection, phase association and threshold monitoring, BSSA Vol 79, no 6, 1927-1940) processes the four arrays jointly and presents locations of regional events.
3. The IMS system is operated on the same set of arrivals as ep and GBF and reports also teleseismic events in addition to regional ones.

IMS results are reported in section 3.6.

In addition to these three event association processes, we are running test versions of the so-called Threshold Monitoring (TM) process. This is a process that monitors the seismic amplitude level at the four regional arrays continuously in time to estimate the upper magnitude limit of an event that might go undetected by the network. The current TM process is beamed to several sites of interest, including the Novaya Zemlya test site. Simple displays of so-called threshold curves reveal instants of particular interest; i.e., instants when events above a certain magnitude threshold may have occurred in the target region. Results from the three processes described above are used to help resolve what actually happened during these instances.

NORESS detections

The number of detections (phases) reported from day 274, 1994, through day 090, 1995, was 41,668, giving an average of 229 detections per processed day (182 days processed).

Table 3.5.1 shows daily and hourly distribution of detections for NORESS.

Events automatically located by NORESS

During days 274, 1994, through 090, 1995, 2071 local and regional events were located by NORESS, based on automatic association of P- and S-type arrivals. This gives an average of 12.7 events per processed day (179 days processed). 71% of these events are within 300 km, and 89% of these events are within 1000 km.

ARCESS detections

The number of detections (phases) reported during day 274, 1994, through day 090, 1995, was 83,324, giving an average of 458 detections per processed day (182 days processed).

Table 3.5.2 shows daily and hourly distribution of detections for ARCESS.

Events automatically located by ARCESS

During days 274, 1994, through 090, 1995, 4794 local and regional events were located by ARCESS, based on automatic association of P- and S-type arrivals. This gives an average 26.2 events per processed day (182 days processed). 51% of these events are within 300 km, and 83% of these events are within 1000 km.

FINESS detections

The number of detections (phases) reported during day 274, 1994, through day 090, 1995, was 42,820, giving an average of 252 detections per processed day (182 days processed).

Table 3.5.3 shows daily and hourly distribution of detections for FINESS.

Events automatically located by FINESS

During days 274, 1994, through 090, 1995, 2686 local and regional events were located by FINESS, based on automatic association of P- and S-type arrivals. This gives an average of 14.8 events per processed day (182 days processed). 83% of these events are within 300 km, and 92% of these events are within 1000 km.

GERESS detections

The number of detections (phases) reported from day 274, 1994, through day 090, 1995, was 30,607, giving an average of 168 detections per processed day (182 days processed).

Table 3.5.4 shows daily and hourly distribution of detections for GERESS.

Events automatically located by GERESS

During days 274, 1994, through 090, 1995, 3186 local and regional events were located by GERESS, based on automatic association of P- and S-type arrivals. This gives an average of 17.5 events per processed day (182 days processed). 75% of these events are within 300 km, and 91% of these events are within 1000 km.

Apatity array detections

The number of detections (phases) reported from day 274, 1994, through day 090, 1995, was 122,232, giving an average of 687 detections per processed day (178 days processed).

As described in earlier reports, the data from the Apatity array are transferred by one-way (simplex) radio links to Apatity city. The transmission suffers from radio disturbances that occasionally result in a large number of small data gaps and spikes in the data. In order for

the communication protocol to correct such errors by requesting retransmission of data, a two-way radio link would be needed (duplex radio). However, it should be noted that noise from cultural activities and from the nearby lakes cause most of the unwanted detections. These unwanted detections are "filtered" in the signal processing, as they give seismic velocities that are outside accepted limits for regional and teleseismic phase velocities.

Table 3.5.5 shows daily and hourly distribution of detections for the Apatity array.

Events automatically located by the Apatity array

During days 274, 1994, through 090, 1995, 3416 local and regional events were located by the Apatity array, based on automatic association of P- and S-type arrivals. This gives an average of 19.2 events per processed day (178 days processed). 28% of these events are within 300 km, and 66% of these events are within 1000 km.

Spitsbergen array detections

The number of detections (phases) reported from day 274, 1994, through day 090, 1995, was 156,980, giving an average of 867 detections per processed day (181 days processed).

Table 3.5.6 shows daily and hourly distribution of detections for the Spitsbergen array.

Events automatically located by the Spitsbergen array

During days 274, 1994, through 090, 1995, 2641 local and regional events were located by the Spitsbergen array, based on automatic association of P- and S-type arrivals. This gives an average of 14.7 events per processed day (180 days processed). 43% of these events are within 300 km, and 74% of these events are within 1000 km.

Hagfors array detections

The number of detections (phases) reported from day 274, 1994, through day 090, 1995, was 56,851, giving an average of 321 detections per processed day (177 days processed).

Table 3.5.7 shows daily and hourly distribution of detections for the Hagfors array

Events automatically located by the Hagfors array

During days 274, 1994, through 090, 1995, 1791 local and regional events were located by the Hagfors array, based on automatic association of P- and S-type arrivals. This gives an average of 10.1 events per processed day (177 days processed). 31% of these events are within 300 km, and 74% of these events are within 1000 km

U. Baadshaug

NRS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
274	3	4	1	0	6	4	8	2	9	12	7	12	3	3	12	7	7	9	14	0	3	5	4	6	141	Oct 01 Saturday
275	6	7	0	4	3	6	5	3	6	4	8	6	8	4	5	4	9	5	4	2	2	8	7	3	119	Oct 02 Sunday
276	2	6	12	9	2	4	2	5	1	1	5	4	4	7	8	14	17	15	11	5	11	3	1	19	168	Oct 03 Monday
277	4	3	5	3	4	4	4	6	6	7	8	10	17	32	77	53	58	52	41	33	32	31	29	29	548	Oct 04 Tuesday
278	28	29	16	27	27	18	3	11	10	10	12	17	22	16	29	18	25	22	16	13	18	9	22	9	427	Oct 05 Wednesday
279	8	8	11	6	9	10	8	21	9	17	8	13	21	13	7	18	11	15	9	7	14	7	14	6	270	Oct 06 Thursday
280	7	1	13	7	4	3	2	7	10	3	11	10	15	15	3	11	4	7	9	4	10	5	11	3	175	Oct 07 Friday
281	4	3	1	5	10	9	13	12	5	9	7	4	12	3	4	10	8	9	8	9	5	13	14	5	182	Oct 08 Saturday
282	6	4	7	5	6	2	5	3	21	12	3	27	15	11	12	8	10	2	5	5	7	4	12	6	198	Oct 09 Sunday
283	5	5	12	10	8	6	4	4	2	2	8	9	16	7	9	8	11	7	3	2	9	8	18	6	179	Oct 10 Monday
284	2	8	6	3	5	5	7	0	27	8	7	11	22	10	9	8	7	3	12	0	7	1	9	4	181	Oct 11 Tuesday
285	2	3	12	4	2	3	15	2	2	10	13	10	10	13	9	4	7	5	1	4	11	7	11	5	165	Oct 12 Wednesday
286	10	3	2	11	4	12	1	2	6	5	6	13	14	20	15	14	8	11	5	7	16	3	16	6	210	Oct 13 Thursday
287	10	1	3	6	7	3	3	7	2	10	18	10	10	8	7	16	8	12	5	2	17	19	22	4	210	Oct 14 Friday
288	2	7	5	3	4	4	4	3	7	4	9	7	8	13	2	8	3	2	4	0	5	2	7	0	113	Oct 15 Saturday
289	10	6	5	5	4	8	4	3	2	1	5	4	7	18	6	7	5	4	6	1	5	5	4	3	128	Oct 16 Sunday
290	2	7	5	9	14	19	6	9	9	5	10	6	7	5	17	11	9	5	0	6	7	4	9	0	181	Oct 17 Monday
291	0	9	8	10	3	2	3	5	7	3	9	16	11	12	6	11	13	10	9	4	5	12	8	7	183	Oct 18 Tuesday
292	7	3	7	14	7	2	3	7	5	80	3	14	12	22	12	23	6	9	12	3	8	13	11	1	284	Oct 19 Wednesday
293	6	13	3	13	6	4	1	4	14	20	7	8	13	20	15	15	6	2	4	13	13	3	5	16	224	Oct 20 Thursday
294	5	12	3	8	3	7	4	7	11	12	11	27	29	10	7	6	7	8	8	6	10	3	17	1	222	Oct 21 Friday
295	2	9	5	5	3	6	6	2	4	7	1	3	7	0	5	32	5	3	6	10	7	3	6	6	143	Oct 22 Saturday
296	4	3	6	5	3	6	6	7	12	7	11	10	4	6	6	15	3	0	7	6	5	10	5	4	151	Oct 23 Sunday
297	7	3	4	12	5	3	1	3	7	2	4	17	12	1	9	10	8	8	3	5	12	1	19	4	160	Oct 24 Monday
298	3	10	17	9	6	3	6	7	3	12	7	5	3	16	10	3	11	14	4	7	13	2	16	2	189	Oct 25 Tuesday
299	3	0	19	8	4	6	2	2	7	1	3	3	9	9	19	13	2	5	5	4	13	7	15	3	162	Oct 26 Wednesday
300	3	1	2	14	0	3	2	6	11	13	6	11	13	16	12	27	20	15	2	2	17	2	24	8	230	Oct 27 Thursday
301	6	3	5	10	4	4	3	6	3	2	5	14	19	6	15	6	4	4	4	8	17	9	11	3	171	Oct 28 Friday
302	8	2	0	0	0	0	0	0	0	0	0	0	6	9	10	8	8	3	8	3	3	3	4	2	77	Oct 29 Saturday
303	3	5	9	9	6	2	8	6	8	12	9	5	7	4	4	10	4	8	2	11	2	4	12	2	152	Oct 30 Sunday
304	5	6	6	11	2	5	5	5	0	2	8	6	7	13	11	8	13	11	1	0	11	4	10	5	155	Oct 31 Monday
305	1	1	5	1	4	5	5	1	9	2	14	9	16	11	11	11	5	6	7	2	5	1	10	3	145	Nov 01 Tuesday
306	4	7	1	10	5	2	0	11	11	10	15	16	26	21	28	19	8	6	1	1	12	4	5	0	223	Nov 02 Wednesday
307	7	3	1	13	3	4	11	11	4	1	13	3	8	7	17	14	6	2	3	1	8	14	11	4	169	Nov 03 Thursday
308	4	17	2	9	2	4	11	8	17	3	19	7	18	8	18	1	4	10	6	3	12	4	3	4	194	Nov 04 Friday
309	5	4	4	3	4	17	15	7	13	10	4	8	13	3	4	21	5	12	3	9	6	5	10	11	196	Nov 05 Saturday
310	8	10	14	3	12	8	11	3	8	5	9	11	18	20	9	11	8	15	5	6	11	6	4	7	222	Nov 06 Sunday
311	13	2	2	19	5	5	3	4	6	1	8	5	10	8	16	23	4	0	8	14	13	11	23	14	217	Nov 07 Monday
312	22	31	5	16	6	5	15	23	12	4	10	18	1	24	18	10	11	13	4	2	11	1	20	3	285	Nov 08 Tuesday
313	2	1	8	18	5	4	1	4	3	5	8	9	14	9	21	12	3	3	11	3	8	8	3	1	164	Nov 09 Wednesday
314	5	4	1	15	9	3	5	4	8	8	3	11	11	18	14	13	3	12	16	0	3	9	4	8	187	Nov 10 Thursday
315	4	6	3	4	9	10	7	5	9	3	10	14	24	7	28	3	6	1	5	9	12	10	15	0	204	Nov 11 Friday
316	4	13	5	2	12	1	8	1	7	16	9	9	10	4	5	3	6	4	14	8	5	3	5	2	156	Nov 12 Saturday
317	6	9	4	4	13	14	6	16	12	6	2	8	4	4	10	9	1	9	9	11	17	32	11	13	230	Nov 13 Sunday
318	5	12	8	16	36	5	5	10	16	9	11	12	10	10	24	26	13	5	12	26	7	11	48	16	353	Nov 14 Monday
319	26	29	16	21	16	6	6	5	4	73	3	9	8	18	28	6	6	9	11	2	18	18	18	9	365	Nov 15 Tuesday
320	16	7	2	23	9	13	7	10	9	8	13	12	23	14	14	5	3	10	6	10	7	14	22	9	266	Nov 16 Wednesday
321	14	4	12	18	5	3	1	4	11	12	27	15	28	35	49	37	17	10	8	18	32	7	2	7	376	Nov 17 Thursday
322	1	2	6	20	10	2	5	8	11	15	5	18	13	14	27	23	20	16	33	30	42	54	26	34	435	Nov 18 Friday
323	34	29	13	23	45	22	28	24	18	19	12	11	9	11	12	19	9	3	11	18	9	21	13	24	437	Nov 19 Saturday
324	30	11	23	25	20	20	33	21	23	17	11	11	10	15	12	4	23	12	9	3	10	7	7	13	370	Nov 20 Sunday
325	4	16	15	10	7	3	10	13	26	12	14	9	19	24	16	3	0	0	0	0	0	0	9	4	214	Nov 21 Monday
326	37	8	10	11	14	18	15	26	24	21	32	42	29	18	13	9	2	5	2	4	7	6	13	1	367	Nov 22 Tuesday
327	5	8	17	6	13	3	6	2	3	9	9	18	12	15	5	7	3	3	6	1	10	17	13	4	195	Nov 23 Wednesday
328	6	9	9	8	7	11	2	10	5	5	0	4	7	17	24	13	7	4	0	10	22	5	18	8	211	Nov 24 Thursday
329	7	5	7	16	15	12	14	8	6	16	10	13	7	10	12	2	7	13	11	2	18	12	11	3	237	Nov 25 Friday

Table 3.5.1 (Page 1 of 4)

NRS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
330	5	6	11	6	9	11	12	8	13	6	12	12	13	4	6	11	11	22	23	15	8	30	11	23	288	Nov 26 Saturday
331	23	3	2	1	8	4	16	13	15	8	8	6	5	22	17	25	17	9	5	11	3	25	11	7	264	Nov 27 Sunday
332	4	17	13	7	8	4	1	2	2	1	4	8	8	12	11	7	2	7	2	5	12	3	7	12	159	Nov 28 Monday
333	5	23	16	5	4	8	11	7	6	5	21	10	35	15	15	6	5	5	1	0	12	1	9	1	226	Nov 29 Tuesday
334	9	18	14	7	14	21	19	24	11	16	16	12	29	18	35	29	24	30	14	17	20	2	21	10	430	Nov 30 Wednesday
335	3	1	6	13	9	3	6	7	8	4	9	13	16	23	6	10	0	5	10	2	11	3	20	2	190	Dec 01 Thursday
336	5	2	3	8	11	0	8	5	9	10	16	17	21	28	13	10	3	10	12	8	10	14	4	21	248	Dec 02 Friday
337	5	8	2	7	6	6	6	7	9	10	5	10	17	13	13	13	8	10	3	7	10	1	2	0	178	Dec 03 Saturday
338	3	1	2	9	9	12	7	5	9	0	10	8	10	6	9	7	0	9	5	3	3	2	5	3	137	Dec 04 Sunday
339	2	8	16	7	1	13	2	7	5	17	4	22	26	21	20	5	20	10	5	1	11	7	11	3	244	Dec 05 Monday
340	7	2	7	7	11	8	2	2	21	2	8	25	31	28	10	1	4	15	1	1	6	17	2	13	231	Dec 06 Tuesday
341	2	9	1	17	3	1	1	15	9	12	21	14	13	22	15	6	6	1	1	6	4	4	4	2	189	Dec 07 Wednesday
342	2	4	1	13	5	10	7	2	5	17	15	15	10	22	13	9	6	0	3	7	12	10	5	1	194	Dec 08 Thursday
343	7	14	12	6	2	3	6	12	20	0	7	17	29	22	6	7	7	8	4	5	9	9	3	16	231	Dec 09 Friday
344	3	3	7	2	8	2	2	2	13	10	4	4	6	19	4	7	14	3	3	12	2	3	1	3	137	Dec 10 Saturday
345	2	1	3	6	3	7	3	8	12	7	12	18	8	17	14	18	3	17	0	1	2	1	10	2	175	Dec 11 Sunday
346	1	11	8	22	8	6	5	41	18	16	37	6	10	11	35	32	23	14	22	22	24	23	27	35	457	Dec 12 Monday
347	30	16	9	5	13	24	28	29	24	13	18	5	18	9	18	11	5	5	5	6	16	18	33	58	416	Dec 13 Tuesday
348	50	41	24	14	4	1	6	22	8	9	10	4	27	9	12	9	15	22	41	45	51	18	37	59	538	Dec 14 Wednesday
349	72	85	66	50	54	42	41	23	31	20	19	18	11	31	46	20	2	6	0	4	32	0	13	19	705	Dec 15 Thursday
350	4	5	8	14	6	9	5	23	13	7	13	8	13	13	11	5	1	3	2	2	13	6	13	3	200	Dec 16 Friday
351	2	1	3	4	7	21	24	26	24	17	15	8	6	17	6	7	6	2	1	2	1	8	3	6	217	Dec 17 Saturday
352	2	3	2	2	5	8	3	1	4	2	2	9	13	1	4	0	3	4	1	11	6	3	0	6	95	Dec 18 Sunday
353	2	5	8	4	13	3	2	14	14	9	22	10	6	8	14	7	1	6	7	6	6	11	3	2	183	Dec 19 Monday
354	3	2	9	5	1	4	9	12	11	9	27	18	17	27	30	30	21	12	6	12	12	13	17	17	324	Dec 20 Tuesday
355	12	19	15	15	29	8	5	5	24	5	25	16	18	22	25	6	22	32	24	35	24	30	33	46	495	Dec 21 Wednesday
356	67	71	54	37	49	46	35	42	30	8	5	10	8	26	17	5	22	22	25	6	27	12	7	2	633	Dec 22 Thursday
357	5	3	6	5	3	4	3	1	5	5	6	7	15	7	6	3	3	1	4	13	0	3	2	5	115	Dec 23 Friday
358	1	2	3	4	1	3	3	2	1	7	4	5	7	5	21	24	41	40	3	15	21	5	2	2	222	Dec 24 Saturday
359	7	77	84	68	51	16	6	5	3	7	5	3	7	4	0	4	3	0	2	1	1	3	4	3	364	Dec 25 Sunday
360	6	2	1	5	1	4	2	5	3	5	10	18	35	73	83	47	33	33	31	18	20	18	16	11	480	Dec 26 Monday
361	6	4	3	7	8	9	5	10	5	3	10	9	5	13	19	4	1	14	2	3	12	6	2	2	162	Dec 27 Tuesday
362	3	2	0	10	3	5	6	2	3	2	4	7	35	12	16	4	6	8	6	7	6	17	14	9	187	Dec 28 Wednesday
363	5	2	2	2	4	2	7	4	2	6	9	11	19	5	6	12	8	2	5	12	4	0	1	2	132	Dec 29 Thursday
364	5	4	4	3	8	0	4	2	3	2	8	20	18	6	16	8	2	2	4	7	1	4	7	7	145	Dec 30 Friday
365	2	6	1	4	6	1	6	4	11	0	4	8	4	1	9	6	2	7	3	1	5	4	4	3	102	Dec 31 Saturday
1	6	2	7	3	4	2	5	12	5	4	2	2	8	3	4	3	2	3	0	2	14	7	5	6	111	Jan 01 Sunday
2	2	4	6	5	3	2	1	5	1	0	5	10	10	6	5	10	9	4	4	4	12	12	8	4	132	Jan 02 Monday
3	13	6	8	16	15	5	12	6	7	6	1	6	5	14	13	11	10	15	10	9	12	11	8	12	231	Jan 03 Tuesday
4	13	9	11	8	7	3	4	3	9	3	4	8	6	12	5	6	2	13	4	3	2	3	6	9	153	Jan 04 Wednesday
5	9	4	4	0	1	0	0	4	1	6	3	9	15	10	11	5	1	5	6	4	2	2	3	4	109	Jan 05 Thursday
6	7	2	3	1	4	5	3	4	5	15	12	13	20	26	11	4	11	1	3	6	10	3	15	10	194	Jan 06 Friday
7	0	3	11	3	3	3	4	5	5	6	6	1	7	7	5	3	10	2	0	2	4	2	3	2	97	Jan 07 Saturday
8	3	5	1	1	2	0	3	3	4	8	1	1	2	10	13	2	3	10	3	7	2	2	1	0	87	Jan 08 Sunday
9	2	2	3	6	3	8	4	2	7	4	5	16	9	12	10	6	5	6	6	4	4	1	5	2	132	Jan 09 Monday
10	3	3	5	6	0	2	4	7	10	2	9	11	13	11	15	6	5	1	4	5	3	8	0	8	141	Jan 10 Tuesday
11	5	3	9	4	3	4	4	5	2	12	5	6	10	5	23	15	9	5	6	4	7	4	3	6	159	Jan 11 Wednesday
12	6	2	1	6	0	4	3	7	7	6	8	4	5	13	15	5	2	10	2	2	3	2	1	3	117	Jan 12 Thursday
13	3	9	3	13	14	4	2	12	10	7	15	6	8	10	6	5	8	2	4	0	10	2	12	2	167	Jan 13 Friday
14	2	1	3	1	1	2	0	4	3	2	3	8	14	5	3	3	3	0	2	4	4	1	2	3	74	Jan 14 Saturday
15	4	3	9	3	4	2	5	3	2	1	1	4	3	4	7	3	9	4	3	0	2	5	1	2	84	Jan 15 Sunday
16	6	0	3	5	2	2	2	8	1	4	5	3	7	8	12	7	6	3	10	3	8	1	7	3	116	Jan 16 Monday
17	2	3	6	3	2	0	3	2	4	8	3	7	6	12	10	6	6	6	6	2	4	6	12	1	120	Jan 17 Tuesday
18	6	5	7	0	0	6	2	4	5	6	6	3	16	13	14	5	4	7	3	5	12	3	10	6	148	Jan 18 Wednesday
19	5	1	10	6	2	3	17	7	1	1	0	0	7	20	23	33	4	6	5	3	7	9	2	2	174	Jan 19 Thursday
20	5	2	6	5	1	3	2	7	3	2	6	5	14	7	10	7	6	4	6	3	9	3	14	2	132	Jan 20 Friday

Table 3.5.1 (Page 2 of 4)

NRS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
21	11	3	7	5	0	2	0	13	10	3	4	13	18	7	3	0	5	11	4	2	0	5	0	4	130	Jan 21 Saturday
22	9	15	18	14	22	17	5	25	31	27	26	26	24	15	3	0	6	3	5	9	13	7	5	11	336	Jan 22 Sunday
23	9	27	12	6	5	5	3	4	7	4	11	3	18	16	16	2	3	7	7	2	4	1	1	4	177	Jan 23 Monday
24	4	0	7	11	13	4	3	5	5	8	4	4	15	14	7	12	9	10	9	9	13	6	10	9	191	Jan 24 Tuesday
25	2	2	1	13	17	5	3	7	4	11	8	5	15	10	9	11	13	10	12	27	16	17	15	23	256	Jan 25 Wednesday
26	24	18	11	11	9	17	7	10	1	5	2	13	15	6	18	8	7	6	4	13	15	19	20	15	274	Jan 26 Thursday
27	13	20	3	7	18	25	16	14	4	7	11	5	14	4	11	3	12	10	21	23	42	26	34	37	380	Jan 27 Friday
28	20	21	5	10	4	10	3	8	8	7	11	11	15	4	6	5	31	47	40	41	47	45	58	50	507	Jan 28 Saturday
29	37	29	42	35	69	51	64	43	35	13	5	7	8	4	10	30	42	52	58	52	15	10	15	0	726	Jan 29 Sunday
30	14	21	17	12	15	6	0	13	4	10	7	1	5	15	9	10	15	7	18	25	26	31	42	38	361	Jan 30 Monday
31	57	42	43	48	29	2	9	7	4	4	10	4	17	7	9	17	1	2	2	5	3	3	9	0	334	Jan 31 Tuesday
32	6	1	1	0	14	5	0	1	7	3	5	8	8	11	12	9	9	3	2	3	5	13	11	3	140	Feb 01 Wednesday
33	3	1	2	8	1	2	2	5	18	5	3	10	5	11	16	11	8	1	2	5	14	53	50	59	295	Feb 02 Thursday
34	87	81	70	68	69	6	5	15	7	8	7	2	19	10	4	7	0	2	1	5	14	5	11	4	507	Feb 03 Friday
35	2	1	1	1	0	1	3	1	3	4	6	6	4	3	2	8	2	6	0	4	4	8	4	1	75	Feb 04 Saturday
36	3	2	0	3	7	4	0	2	2	8	7	9	5	4	4	4	6	2	7	7	8	2	1	28	125	Feb 05 Sunday
37	17	12	5	8	2	5	4	2	6	3	4	11	15	12	19	9	9	16	1	2	10	2	6	1	181	Feb 06 Monday
38	1	0	4	3	5	3	2	7	12	3	11	6	16	16	11	16	18	13	16	17	14	9	10	9	222	Feb 07 Tuesday
39	6	7	10	1	3	3	10	2	6	5	12	5	14	12	14	10	7	7	7	2	13	13	8	3	180	Feb 08 Wednesday
40	10	7	12	5	10	1	2	3	5	7	13	20	12	7	13	12	5	7	7	9	6	0	1	2	176	Feb 09 Thursday
41	2	6	21	21	29	21	7	9	7	3	8	4	17	8	3	2	7	8	14	6	18	10	18	35	284	Feb 10 Friday
42	32	46	50	41	60	53	40	39	32	16	11	19	18	16	2	19	7	6	10	7	12	5	9	11	561	Feb 11 Saturday
43	7	14	6	19	13	11	12	11	13	10	13	9	8	6	0	2	2	1	9	4	8	9	3	3	193	Feb 12 Sunday
44	6	5	4	0	3	2	6	2	8	7	3	3	6	11	4	23	7	4	0	2	4	10	11	3	134	Feb 13 Monday
45	1	9	1	4	2	5	1	4	1	5	6	6	9	14	13	7	4	9	3	0	10	2	4	2	122	Feb 14 Tuesday
46	2	10	12	2	1	5	1	4	3	3	9	9	14	13	8	9	3	9	1	1	8	0	9	1	137	Feb 15 Wednesday
47	1	1	1	4	3	1	7	0	6	5	6	3	5	12	20	10	5	0	9	5	7	2	0	0	113	Feb 16 Thursday
48	2	3	12	1	4	3	3	2	1	2	5	8	11	17	6	8	3	7	5	9	11	2	6	0	131	Feb 17 Friday
49	6	7	7	6	13	9	9	9	9	6	7	9	12	9	4	11	9	18	17	21	26	6	15	10	255	Feb 18 Saturday
50	18	20	24	32	33	21	28	6	9	8	7	9	2	7	4	7	6	1	3	4	1	0	1	4	255	Feb 19 Sunday
51	1	0	5	5	7	3	4	4	15	1	6	8	12	11	11	16	12	4	4	1	7	3	15	3	158	Feb 20 Monday
52	2	6	12	3	9	3	3	1	2	5	9	2	8	14	22	12	3	3	1	2	11	3	12	3	151	Feb 21 Tuesday
53	3	17	73	69	28	44	3	0	8	1	16	9	6	5	15	9	7	7	6	2	3	5	7	5	348	Feb 22 Wednesday
54	1	2	6	5	3	16	4	3	9	5	4	13	14	15	9	12	7	2	4	6	9	12	2	2	165	Feb 23 Thursday
55	4	11	2	3	1	7	5	4	3	7	19	10	14	5	7	20	3	13	21	15	32	34	32	33	305	Feb 24 Friday
56	26	20	32	37	42	23	31	32	27	10	5	17	26	12	11	24	18	27	35	46	36	45	38	40	660	Feb 25 Saturday
57	45	55	49	65	48	37	30	27	21	18	16	8	6	13	7	22	6	2	7	25	14	16	17	17	571	Feb 26 Sunday
58	29	23	19	13	17	22	16	4	15	11	10	8	9	11	9	7	11	29	30	28	34	72	38	3	468	Feb 27 Monday
59	5	2	4	4	4	4	3	3	8	3	7	10	11	7	8	9	2	9	2	2	3	6	3	1	120	Feb 28 Tuesday
60	1	1	6	5	3	10	5	3	4	12	9	4	9	6	7	10	5	13	7	10	8	10	12	11	171	Mar 01 Wednesday
61	12	12	6	13	14	7	9	5	6	2	7	3	9	2	4	6	11	5	7	0	9	4	2	2	157	Mar 02 Thursday
62	6	12	10	9	9	11	6	6	10	6	11	14	19	20	3	9	3	5	3	9	1	16	9	0	207	Mar 03 Friday
63	3	6	4	7	4	4	6	3-	6	3	9	8	4	14	6	6	3	13	31	35	16	3	2	3	199	Mar 04 Saturday
64	1	5	2	1	4	7	7	2	5	12	4	7	5	3	2	18	5	12	11	5	4	10	13	1	146	Mar 05 Sunday
65	3	4	7	1	8	16	5	2	2	3	1	15	10	8	9	10	6	10	2	2	12	5	1	4	146	Mar 06 Monday
66	2	17	7	17	4	3	3	4	1	5	11	4	9	9	2	10	8	4	6	2	19	0	13	9	169	Mar 07 Tuesday
67	7	21	5	12	2	7	5	4	5	12	8	10	5	12	17	14	9	11	6	7	7	5	2	10	203	Mar 08 Wednesday
68	12	5	3	2	7	7	6	9	0	9	3	4	18	4	5	15	5	13	11	2	14	5	5	10	174	Mar 09 Thursday
69	6	7	2	8	3	9	7	6	3	6	8	8	16	4	7	19	8	6	2	13	9	11	1	0	169	Mar 10 Friday
70	2	1	2	0	2	7	6	10	18	9	4	14	7	7	11	12	5	4	2	6	4	2	4	4	143	Mar 11 Saturday
71	2	2	3	2	7	5	1	5	3	9	2	5	8	0	4	3	3	5	5	3	4	3	5	4	93	Mar 12 Sunday
72	2	3	8	5	0	2	1	2	12	7	2	10	9	5	9	6	11	7	10	17	25	20	12	13	198	Mar 13 Monday
73	6	4	7	10	5	3	1	3	7	5	6	9	12	18	18	15	7	12	5	4	6	5	11	1	180	Mar 14 Tuesday
74	3	8	9	10	4	2	1	3	4	4	8	14	15	17	10	11	11	14	3	6	3	2	11	1	174	Mar 15 Wednesday
75	0	6	8	5	5	2	4	5	2	5	9	7	7	11	8	9	12	11	6	1	7	8	24	5	167	Mar 16 Thursday
76	3	7	2	1	3	4	4	4	11	10	4	5	10	7	5	4	4	0	3	6	7	6	3	9	122	Mar 17 Friday

Table 3.5.1 (Page 3 of 4)

NRS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
77	2	4	0	7	1	7	3	12	38	6	6	11	4	6	9	4	4	5	9	6	9	3	5	1	162	Mar 18 Saturday
78	4	5	2	21	24	12	18	16	6	1	8	7	18	3	2	1	2	4	3	4	13	12	17	9	212	Mar 19 Sunday
79	21	13	24	25	17	12	4	9	4	1	11	1	4	10	11	20	5	5	9	4	8	3	7	3	231	Mar 20 Monday
80	3	6	9	5	4	3	3	6	2	7	2	15	20	9	12	1	5	2	9	7	16	4	9	6	165	Mar 21 Tuesday
81	13	1	6	11	2	12	4	7	2	6	8	7	14	12	12	6	39	49	8	5	17	5	10	5	261	Mar 22 Wednesday
82	8	3	13	13	10	5	3	2	1	8	20	14	10	5	11	8	9	15	5	2	14	2	17	1	199	Mar 23 Thursday
83	3	4	8	4	5	8	2	8	5	13	9	14	14	7	12	2	5	11	4	2	25	4	1	0	170	Mar 24 Friday
84	5	0	6	10	28	11	2	8	8	4	11	17	2	5	10	6	2	3	5	11	20	22	19	44	259	Mar 25 Saturday
85	45	39	47	45	42	25	8	38	75	80	81	9	10	3	7	6	14	11	6	9	0	2	1	1	604	Mar 26 Sunday
86	1	1	8	3	3	7	2	3	9	8	2	16	15	14	15	11	4	9	10	9	10	13	12	12	197	Mar 27 Monday
87	10	11	1	3	9	4	6	6	12	4	6	12	12	17	9	2	8	14	4	6	3	6	5	0	170	Mar 28 Tuesday
88	2	0	5	0	6	1	3	2	8	15	6	10	18	21	8	10	11	6	4	9	3	10	12	5	175	Mar 29 Wednesday
89	13	9	34	21	21	15	7	5	4	26	18	17	16	2	20	15	5	13	10	9	1	12	7	4	304	Mar 30 Thursday
90	5	8	5	3	6	3	7	6	4	16	4	9	4	12	17	6	4	0	4	11	5	5	3	3	150	Mar 31 Friday

NRS	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum		1774		1937		1457		1470		1548		1781		2154		1958		1644		1446		1646		1541		
	1651		1815		1807		1271		1650		1657		2268		2264		1525		1416		2003		1985		41668	Total sum
182	9	10	10	11	10	8	7	8	9	9	9	10	12	12	12	11	8	9	8	8	11	9	11	8	229	Total average
129	9	10	10	10	9	7	6	7	8	8	9	10	14	13	14	11	8	9	7	7	12	9	12	9	227	Average workdays
53	9	10	11	11	13	10	10	10	12	9	9	9	10	9	8	10	9	10	9	10	9	9	8	8	233	Average weekends

Table 3.5.1. (Page 4 of 4) Daily and hourly distribution of NORESS detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

ARC .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date	
274	15	7	11	8	14	5	6	15	8	22	16	13	27	10	19	17	10	17	30	15	16	22	17	34	374	Oct 01	Saturday
275	17	19	17	21	14	25	15	5	4	13	32	14	28	14	11	24	24	19	33	31	47	79	62	58	626	Oct 02	Sunday
276	151	32	54	63	81	47	71	47	129	98	78	70	62	29	15	23	43	24	69	52	51	72	86	101	1512	Oct 03	Monday
277	88	93	87	113	145	153	26	16	12	18	35	24	32	50	90	125	95	64	101	44	55	63	22	26	1577	Oct 04	Tuesday
278	39	26	24	25	49	41	25	27	4	0	0	32	34	22	25	74	88	17	15	15	18	15	11	20	646	Oct 05	Wednesday
279	9	8	5	15	16	37	52	62	47	42	24	17	52	21	14	4	13	9	11	13	7	10	12	10	510	Oct 06	Thursday
280	14	8	11	21	23	29	12	11	14	19	17	18	25	19	18	16	27	26	25	17	17	22	12	16	437	Oct 07	Friday
281	10	11	14	19	19	19	4	16	7	16	36	34	22	18	6	4	11	49	41	19	26	40	27	22	490	Oct 08	Saturday
282	20	9	7	10	6	15	11	14	46	15	12	22	33	18	19	24	27	24	11	34	30	13	45	25	490	Oct 09	Sunday
283	23	7	21	32	72	7	20	13	30	25	20	13	22	39	41	22	42	19	19	29	17	18	10	23	584	Oct 10	Monday
284	18	14	10	6	14	13	23	19	20	36	28	75	42	25	10	98	52	58	36	11	14	10	7	13	652	Oct 11	Tuesday
285	13	10	9	7	2	23	25	16	31	6	27	15	6	1	42	36	23	8	12	11	8	13	10	9	363	Oct 12	Wednesday
286	7	17	3	6	7	22	69	39	19	9	10	12	15	14	12	18	32	106	25	10	24	20	26	136	658	Oct 13	Thursday
287	101	63	40	6	15	10	49	43	18	36	21	52	56	15	18	7	12	23	49	7	5	11	8	9	674	Oct 14	Friday
288	10	9	7	10	7	9	4	4	10	4	11	13	16	10	15	37	11	21	24	12	11	19	13	17	304	Oct 15	Saturday
289	12	22	24	12	10	16	10	7	4	5	7	3	8	4	3	4	11	9	13	6	16	5	8	1	220	Oct 16	Sunday
290	6	6	2	5	3	8	23	11	6	21	8	5	2	15	9	18	8	7	5	13	11	9	12	14	227	Oct 17	Monday
291	10	8	10	10	18	22	8	20	10	15	38	22	12	5	20	24	22	15	14	26	16	16	9	44	414	Oct 18	Tuesday
292	17	7	7	9	6	8	15	11	12	15	14	34	38	35	60	65	59	48	41	43	48	49	53	31	725	Oct 19	Wednesday
293	66	70	26	12	16	21	16	11	17	42	20	20	28	35	19	10	5	8	5	12	17	29	7	15	527	Oct 20	Thursday
294	10	10	11	20	31	39	37	41	14	19	15	25	29	38	20	12	11	12	17	22	10	14	8	15	480	Oct 21	Friday
295	7	3	13	7	3	3	9	9	9	17	20	32	13	10	7	8	12	20	13	15	17	14	7	19	287	Oct 22	Saturday
296	21	5	12	11	21	119	148	91	21	15	22	10	11	4	20	125	102	30	117	17	11	14	6	7	960	Oct 23	Sunday
297	16	8	7	6	7	6	20	35	38	11	3	26	24	28	14	8	13	16	5	10	4	12	11	6	334	Oct 24	Monday
298	8	21	6	7	7	14	15	8	8	18	9	17	13	22	8	19	12	14	15	12	6	14	14	11	298	Oct 25	Tuesday
299	11	4	12	16	11	6	1	20	13	33	20	18	45	35	42	58	35	14	15	7	9	10	9	18	462	Oct 26	Wednesday
300	10	8	6	14	2	10	24	20	22	22	8	28	16	18	22	19	18	21	12	6	8	11	24	13	362	Oct 27	Thursday
301	8	6	9	3	2	2	8	10	11	8	6	15	11	27	15	13	11	9	10	13	11	14	9	10	241	Oct 28	Friday
302	16	5	10	9	13	3	4	6	10	28	6	20	39	11	14	28	54	28	63	9	14	15	7	13	425	Oct 29	Saturday
303	12	7	16	6	15	24	16	11	32	43	34	40	54	70	38	21	32	52	102	102	107	111	121	122	1188	Oct 30	Sunday
304	103	81	24	15	10	9	16	17	15	18	23	55	99	156	161	62	33	38	14	17	14	13	4	19	1016	Oct 31	Monday
305	15	12	9	9	3	12	17	15	32	14	15	26	31	16	11	20	34	18	13	13	9	5	12	18	379	Nov 01	Tuesday
306	11	14	18	14	13	14	8	14	8	14	32	24	29	27	12	15	13	9	5	12	11	1	4	18	340	Nov 02	Wednesday
307	15	6	7	11	12	13	4	13	11	18	15	15	21	14	16	8	14	4	5	9	7	5	2	13	258	Nov 03	Thursday
308	14	28	6	7	12	10	6	17	17	7	26	6	42	7	18	11	23	3	10	11	8	16	3	15	323	Nov 04	Friday
309	15	12	10	6	6	8	6	12	11	9	12	14	18	9	8	9	13	24	4	6	1	4	3	17	237	Nov 05	Saturday
310	8	4	5	6	2	1	8	2	6	6	2	11	21	22	12	14	4	3	5	8	5	12	10	11	188	Nov 06	Sunday
311	6	11	24	14	7	16	31	23	16	8	17	7	14	32	21	7	12	8	7	13	28	18	17	9	366	Nov 07	Monday
312	13	2	10	4	7	8	6	1	0	0	0	0	0	0	0	0	20	16	8	6	8	19	32	42	202	Nov 08	Tuesday
313	43	32	59	75	97	100	93	77	60	42	18	17	27	26	23	36	25	19	33	64	71	64	54	39	1194	Nov 09	Wednesday
314	50	20	5	13	16	5	8	23	20	10	7	19	29	42	23	44	30	42	16	52	73	63	84	47	741	Nov 10	Thursday
315	21	18	7	21	12	9	2	33	15	10	33	17	34	28	11	10	7	12	12	8	7	9	10	14	360	Nov 11	Friday
316	13	6	8	14	10	7	8	8	4	15	14	7	16	10	6	6	4	2	5	14	4	3	2	14	200	Nov 12	Saturday
317	17	4	6	5	6	10	2	12	6	9	3	3	9	11	12	6	10	4	9	9	14	8	7	15	197	Nov 13	Sunday
318	15	11	2	5	10	12	5	3	8	13	15	15	11	7	11	10	3	7	8	16	15	9	14	15	240	Nov 14	Monday
319	18	8	13	16	3	14	17	28	29	11	17	24	24	18	18	16	16	6	11	11	17	8	13	9	365	Nov 15	Tuesday
320	12	4	17	15	6	7	8	8	11	5	12	15	33	13	18	16	3	12	14	12	17	14	12	17	301	Nov 16	Wednesday
321	14	14	14	8	10	4	13	4	12	9	11	8	38	13	30	24	19	5	8	10	12	1	10	12	303	Nov 17	Thursday
322	11	3	9	10	6	5	3	8	17	15	17	17	24	21	14	9	7	10	10	13	6	13	10	11	269	Nov 18	Friday
323	20	6	7	8	14	5	9	10	17	14	6	29	9	4	10	3	16	8	14	5	9	17	11	21	272	Nov 19	Saturday
324	13	8	14	7	3	15	10	5	9	11	3	14	22	6	16	10	12	20	13	11	16	18	11	8	275	Nov 20	Sunday
325	15	3	5	10	6	7	12	14	15	19	14	8	12	13	18	12	13	7	6	9	8	9	8	13	256	Nov 21	Monday
326	14	4	12	6	5	11	9	7	7	13	13	20	25	13	10	26	8	16	13	13	15	12	11	8	291	Nov 22	Tuesday
327	20	3	11	6	9	11	12	9	17	16	23	13	23	19	8	11	17	5	25	7	12	16	8	13	314	Nov 23	Wednesday
328	16	7	8	8	13	10	15	5	11	10	19	13	19	16	6	27	14	10	8	14	6	5	9	10	279	Nov 24	Thursday
329	15	5	6	9	4	17	9	6	16	13	18	23	19	32	11	6	15	10	6	8	14	18	8	7	295	Nov 25	Friday

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ARC .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
330	15	4	13	15	7	6	7	6	19	19	16	18	20	12	8	9	3	8	2	2	9	4	7	15	244	Nov 26 Saturday
331	6	4	0	6	2	4	10	14	6	4	9	8	2	4	4	4	10	5	4	7	4	2	8	6	133	Nov 27 Sunday
332	10	4	4	10	6	17	8	5	13	5	10	8	15	11	13	1	21	3	17	7	7	7	6	3	211	Nov 28 Monday
333	11	4	6	2	10	4	9	7	11	11	18	15	22	15	12	16	17	8	7	16	8	8	13	18	268	Nov 29 Tuesday
334	16	11	9	12	10	13	4	8	10	23	13	21	27	12	10	14	18	17	8	12	10	2	11	4	295	Nov 30 Wednesday
335	10	5	9	4	15	9	9	12	10	18	6	16	15	12	8	9	3	11	2	3	5	4	5	12	212	Dec 01 Thursday
336	10	4	4	2	3	2	12	5	10	8	2	14	23	13	9	8	12	9	13	6	11	7	7	10	204	Dec 02 Friday
337	5	5	8	5	14	14	7	13	11	9	12	10	7	6	15	8	12	6	9	9	6	13	4	9	217	Dec 03 Saturday
338	11	10	7	6	7	9	2	5	8	3	4	8	11	1	7	5	12	8	5	7	6	11	15	23	191	Dec 04 Sunday
339	14	8	4	9	11	11	8	10	10	7	9	16	11	11	16	14	17	16	14	15	17	19	19	17	303	Dec 05 Monday
340	15	14	18	13	14	9	9	9	20	3	16	5	12	6	6	9	9	7	12	8	9	12	10	14	259	Dec 06 Tuesday
341	17	12	20	16	25	15	18	13	23	20	19	16	21	21	16	11	17	18	8	9	12	8	18	13	386	Dec 07 Wednesday
342	13	6	8	9	8	7	8	5	26	9	12	12	18	21	13	11	8	6	15	7	8	6	8	9	253	Dec 08 Thursday
343	13	7	12	6	7	14	7	10	12	21	25	15	24	6	17	16	11	6	14	16	15	12	13	21	320	Dec 09 Friday
344	15	9	12	4	11	5	4	3	9	16	23	9	24	12	6	13	14	15	15	10	8	13	8	18	276	Dec 10 Saturday
345	10	6	12	10	5	13	5	11	8	18	9	6	7	8	7	15	5	3	3	12	6	7	9	16	211	Dec 11 Sunday
346	12	9	9	8	6	13	14	4	16	20	20	10	15	0	0	10	9	15	14	15	8	1	2	16	246	Dec 12 Monday
347	17	10	5	4	10	6	2	9	12	15	17	18	16	15	18	6	27	12	15	11	15	8	7	18	293	Dec 13 Tuesday
348	13	2	9	3	9	4	12	8	7	10	16	0	0	17	8	11	16	19	4	13	17	26	9	24	257	Dec 14 Wednesday
349	22	8	18	17	12	20	11	5	15	32	27	31	25	24	21	18	17	10	12	14	17	9	14	31	430	Dec 15 Thursday
350	17	8	2	5	13	14	19	11	3	0	0	0	0	0	6	18	7	10	12	9	19	10	10	16	209	Dec 16 Friday
351	26	12	11	17	12	11	16	9	14	17	6	21	9	13	8	6	19	11	4	11	14	13	18	15	313	Dec 17 Saturday
352	13	8	11	7	17	21	14	12	16	8	19	25	8	7	3	11	12	14	18	18	12	13	7	7	301	Dec 18 Sunday
353	16	13	9	22	13	10	10	25	16	10	17	21	16	25	18	21	17	8	11	6	11	6	9	22	352	Dec 19 Monday
354	10	3	4	14	12	12	7	15	9	10	23	12	22	19	10	13	3	9	8	14	14	16	8	15	282	Dec 20 Tuesday
355	15	13	7	8	14	14	11	31	18	13	28	19	29	18	30	18	122	30	76	36	41	12	88	100	791	Dec 21 Wednesday
356	66	44	18	10	23	21	10	18	16	13	8	48	31	14	43	57	114	40	48	7	100	45	19	8	821	Dec 22 Thursday
357	12	3	1	12	7	3	4	12	7	34	50	6	27	18	29	26	4	0	3	0	3	6	4	12	283	Dec 23 Friday
358	18	1	3	4	3	7	7	11	4	24	18	6	16	7	10	12	3	9	11	1	2	6	11	11	205	Dec 24 Saturday
359	4	5	8	14	17	3	6	10	16	7	11	14	11	16	15	3	11	12	6	17	23	3	8	13	253	Dec 25 Sunday
360	4	3	8	18	3	1	15	12	9	17	14	10	18	17	12	18	5	10	14	7	26	5	3	10	259	Dec 26 Monday
361	5	14	5	14	22	12	9	15	10	21	22	7	10	24	4	15	21	23	19	28	7	24	10	10	351	Dec 27 Tuesday
362	14	5	5	9	22	6	8	2	10	23	25	20	48	24	10	17	22	8	10	18	12	30	25	22	395	Dec 28 Wednesday
363	9	6	8	7	17	18	14	9	9	16	27	25	12	14	19	10	26	23	20	19	24	15	19	31	397	Dec 29 Thursday
364	15	16	4	8	9	5	19	19	14	12	22	26	26	31	15	35	13	11	16	9	6	11	25	20	387	Dec 30 Friday
365	16	15	9	7	10	7	7	10	21	5	7	14	11	8	20	15	5	16	16	6	27	15	4	11	282	Dec 31 Saturday
1	22	8	18	17	4	6	3	15	7	6	5	10	13	13	13	12	10	24	9	18	11	16	14	18	292	Jan 01 Sunday
2	11	11	22	10	15	13	10	7	5	7	12	15	23	11	14	5	15	11	22	11	15	32	16	14	327	Jan 02 Monday
3	23	16	2	22	11	6	18	11	12	8	13	20	6	20	15	8	9	3	15	15	21	16	10	22	322	Jan 03 Tuesday
4	15	12	22	11	15	23	11	11	23	11	3	9	18	14	16	22	32	6	4	6	9	20	15	13	341	Jan 04 Wednesday
5	18	14	7	10	17	8	7	19	12	19	22	23	15	9	5	2	13	10	12	12	13	22	9	12	310	Jan 05 Thursday
6	20	0	3	16	10	6	5	17	25	17	21	20	32	7	4	4	20	2	8	16	11	21	14	11	310	Jan 06 Friday
7	18	21	9	5	14	11	6	11	5	10	14	11	21	5	7	6	7	9	2	6	14	5	5	11	233	Jan 07 Saturday
8	11	5	14	5	7	24	8	16	13	10	10	14	10	18	12	14	5	5	6	6	12	13	3	3	244	Jan 08 Sunday
9	10	3	11	8	5	8	9	4	7	5	10	11	22	6	2	7	12	8	17	4	6	3	9	15	202	Jan 09 Monday
10	8	12	19	4	7	17	2	12	25	1	23	27	26	32	13	7	8	18	13	7	5	7	12	15	320	Jan 10 Tuesday
11	19	11	8	21	7	8	13	16	10	18	30	10	35	13	14	24	11	8	13	7	12	4	11	16	339	Jan 11 Wednesday
12	11	3	6	10	20	12	13	13	19	7	25	32	19	21	23	9	28	12	5	7	3	9	3	19	329	Jan 12 Thursday
13	22	6	8	13	13	17	21	12	15	32	19	16	23	10	12	14	11	10	16	11	18	30	11	22	382	Jan 13 Friday
14	26	11	8	12	19	10	8	16	20	24	14	28	14	13	1	2	5	6	9	23	10	8	12	23	322	Jan 14 Saturday
15	13	9	22	9	14	12	22	47	20	19	27	6	7	9	11	10	16	15	12	8	6	7	8	15	344	Jan 15 Sunday
16	33	11	11	14	10	10	23	19	17	19	16	20	23	14	12	12	7	3	14	26	13	10	7	9	353	Jan 16 Monday
17	13	14	10	9	9	10	8	12	16	9	13	24	8	16	12	13	17	23	7	10	3	20	17	24	317	Jan 17 Tuesday
18	14	15	29	20	15	17	7	22	20	13	16	25	29	13	13	11	25	15	8	11	13	6	7	16	380	Jan 18 Wednesday
19	14	7	5	12	13	6	10	7	10	12	26	27	14	16	32	44	39	61	84	86	83	84	28	28	748	Jan 19 Thursday
20	21	8	10	11	14	9	6	18	16	12	8	12	18	17	12	8	16	24	8	5	10	10	21	10	304	Jan 20 Friday

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ARC .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
21	12	17	13	18	23	19	7	36	16	12	8	25	23	20	21	12	11	6	3	6	19	15	4	22	368	Jan 21 Saturday
22	19	9	5	13	11	4	18	11	7	24	25	30	22	44	70	81	129	103	99	122	87	66	43	71	1113	Jan 22 Sunday
23	82	71	42	37	31	41	24	26	17	28	31	81	122	146	101	34	30	6	19	7	7	5	12	11	1011	Jan 23 Monday
24	16	12	16	7	22	7	14	24	12	14	16	23	30	22	13	10	22	8	11	15	21	16	13	26	390	Jan 24 Tuesday
25	18	10	8	14	5	14	15	11	20	16	20	22	41	22	20	28	24	27	15	23	11	11	13	20	428	Jan 25 Wednesday
26	13	8	4	5	20	18	9	18	17	9	13	33	12	28	18	8	17	14	11	16	4	8	6	12	321	Jan 26 Thursday
27	23	15	8	9	11	9	11	12	21	18	25	20	28	22	14	6	23	9	17	20	18	15	10	16	380	Jan 27 Friday
28	10	11	14	15	13	11	5	4	13	19	15	33	15	6	13	23	19	13	33	32	27	19	4	16	383	Jan 28 Saturday
29	22	17	13	19	23	22	14	24	5	7	7	8	11	17	15	11	19	37	39	24	32	27	33	58	504	Jan 29 Sunday
30	65	64	60	45	72	81	112	107	131	97	86	56	0	79	102	106	106	92	78	79	82	61	63	91	1915	Jan 30 Monday
31	83	78	84	69	45	31	19	18	9	7	7	12	17	19	25	20	26	29	42	35	31	28	30	24	788	Jan 31 Tuesday
32	34	14	20	21	10	15	12	2	6	14	10	20	18	9	9	13	16	2	4	19	8	11	16	26	329	Feb 01 Wednesday
33	9	10	14	10	12	19	5	16	11	9	24	8	11	14	12	12	1	11	29	31	51	54	69	70	512	Feb 02 Thursday
34	65	64	64	65	95	96	83	100	90	77	66	75	62	91	92	52	26	24	25	15	17	15	10	15	1384	Feb 03 Friday
35	23	10	19	30	15	19	15	23	10	22	2	19	17	21	22	25	7	7	9	9	9	9	19	12	373	Feb 04 Saturday
36	12	2	2	5	14	10	2	8	10	4	7	13	7	10	7	8	10	9	6	11	10	4	0	53	224	Feb 05 Sunday
37	57	40	25	30	23	20	37	31	29	34	26	45	58	61	50	25	40	19	23	25	17	7	12	14	748	Feb 06 Monday
38	12	12	17	23	17	10	5	7	12	22	8	99	58	45	89	68	10	9	6	9	15	9	13	11	586	Feb 07 Tuesday
39	17	5	5	15	21	8	12	11	18	7	38	85	66	102	15	70	84	80	18	14	13	15	8	11	738	Feb 08 Wednesday
40	14	5	16	30	8	21	9	9	25	99	53	98	54	113	71	15	18	8	16	7	11	15	9	13	737	Feb 09 Thursday
41	24	8	31	19	16	12	10	16	10	45	49	54	66	42	21	4	10	11	13	19	21	13	24	31	569	Feb 10 Friday
42	23	12	14	25	25	17	36	24	21	19	29	24	56	44	63	77	77	55	61	66	81	68	76	69	1062	Feb 11 Saturday
43	53	56	68	71	73	69	86	91	83	68	51	54	49	52	70	79	78	77	89	87	104	96	84	81	1769	Feb 12 Sunday
44	97	86	74	50	43	48	38	28	23	19	17	11	27	35	21	28	22	16	14	9	15	9	12	4	746	Feb 13 Monday
45	34	27	14	7	6	22	13	11	17	20	15	19	28	17	11	22	28	19	23	10	12	15	17	10	417	Feb 14 Tuesday
46	24	8	16	13	15	24	7	13	20	13	43	16	39	26	19	13	18	17	25	23	15	8	10	19	444	Feb 15 Wednesday
47	15	10	14	8	14	5	12	10	7	34	15	31	32	18	19	35	15	16	28	14	26	16	23	19	436	Feb 16 Thursday
48	17	18	16	24	15	17	12	19	22	21	17	23	48	26	23	7	12	20	8	21	19	3	8	7	423	Feb 17 Friday
49	23	12	24	11	9	13	7	20	8	17	21	12	13	9	17	7	18	27	8	8	5	2	5	12	308	Feb 18 Saturday
50	20	4	21	9	17	15	9	6	36	1	13	15	9	9	13	7	6	12	5	8	7	11	5	10	268	Feb 19 Sunday
51	16	15	9	6	11	14	17	13	23	24	11	16	24	16	14	9	17	4	7	7	11	13	8	11	316	Feb 20 Monday
52	16	3	18	15	10	9	11	12	18	13	21	27	23	16	21	12	20	7	4	19	8	21	2	6	332	Feb 21 Tuesday
53	13	5	10	13	3	8	11	12	8	16	29	27	33	11	23	12	13	1	6	11	3	4	15	24	311	Feb 22 Wednesday
54	14	9	9	8	12	23	14	22	7	19	23	29	20	13	8	10	19	7	7	16	14	24	14	18	359	Feb 23 Thursday
55	11	22	7	6	18	13	17	16	24	19	32	29	36	39	26	19	13	7	12	19	21	10	9	11	436	Feb 24 Friday
56	16	16	7	10	18	31	11	16	10	25	11	18	30	20	37	8	15	29	9	10	20	11	21	15	414	Feb 25 Saturday
57	15	6	12	13	13	7	24	10	11	15	23	13	17	13	10	20	14	21	10	16	12	4	9	11	319	Feb 26 Sunday
58	28	9	6	15	9	10	13	23	11	24	6	16	21	12	11	13	18	8	19	27	20	21	15	28	383	Feb 27 Monday
59	41	44	32	33	45	39	41	37	25	22	27	19	26	19	24	19	7	15	8	20	19	15	10	18	605	Feb 28 Tuesday
60	18	9	24	3	14	24	16	17	35	12	19	27	25	29	10	10	14	8	13	16	23	11	4	17	398	Mar 01 Wednesday
61	21	13	12	10	15	22	14	16	21	7	18	19	23	17	2	15	16	8	14	18	18	8	18	13	358	Mar 02 Thursday
62	20	23	9	6	22	6	10	26	23	2	0	14	57	33	16	15	26	9	32	9	11	21	19	25	434	Mar 03 Friday
63	21	14	15	14	18	28	12	21	36	23	36	38	25	23	38	17	36	41	51	32	39	15	15	14	622	Mar 04 Saturday
64	13	10	8	12	10	7	7	19	9	17	8	10	15	15	10	19	20	11	8	16	16	26	21	24	331	Mar 05 Sunday
65	13	9	9	7	8	18	13	7	9	10	12	23	12	6	14	19	14	14	16	11	18	13	13	30	318	Mar 06 Monday
66	14	2	2	7	7	11	17	4	18	6	11	15	32	25	6	13	17	13	13	21	9	10	13	25	311	Mar 07 Tuesday
67	18	26	16	10	13	13	10	20	16	25	13	12	26	12	30	22	14	19	22	15	7	12	15	7	393	Mar 08 Wednesday
68	21	17	11	20	17	21	10	25	17	15	24	23	21	23	12	11	23	21	15	18	25	15	9	29	443	Mar 09 Thursday
69	22	13	10	16	9	24	5	16	3	18	19	26	37	20	13	17	20	9	7	17	20	9	18	22	390	Mar 10 Friday
70	17	16	7	12	14	15	10	18	16	5	3	12	14	13	9	17	10	18	8	13	14	10	2	22	295	Mar 11 Saturday
71	20	7	15	6	14	29	4	6	16	6	9	9	15	9	22	6	5	8	9	12	21	9	14	35	306	Mar 12 Sunday
72	20	25	17	22	23	32	14	19	10	11	17	7	15	13	12	7	6	7	15	8	8	21	4	11	344	Mar 13 Monday
73	16	3	12	19	16	17	14	6	17	15	14	19	23	24	14	17	18	18	13	15	17	14	24	14	379	Mar 14 Tuesday
74	23	19	22	13	3	4	11	8	9	17	14	29	19	17	15	15	19	14	11	13	22	9	10	23	359	Mar 15 Wednesday
75	19	21	9	25	20	25	26	11	11	29	9	16	22	12	18	16	25	20	42	17	21	68	140	36	658	Mar 16 Thursday
76	37	51	42	37	30	16	17	19	19	12	21	23	37	24	18	22	15	14	26	20	12	27	20	25	584	Mar 17 Friday

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ARC .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
77	19	10	6	7	16	16	12	16	12	13	10	18	6	15	7	15	30	18	16	10	20	4	8	21	325	Mar 18 Saturday
78	14	28	29	39	58	31	19	6	27	15	18	13	6	11	15	27	15	35	28	16	15	20	17	17	519	Mar 19 Sunday
79	24	26	22	23	25	12	23	14	24	22	16	28	20	12	13	22	13	26	21	23	15	13	18	9	464	Mar 20 Monday
80	19	6	15	20	28	21	17	9	23	22	23	34	24	17	24	29	8	8	67	90	121	123	118	146	1012	Mar 21 Tuesday
81	156	136	114	121	139	110	104	46	44	39	44	50	35	25	23	17	19	20	16	28	20	14	28	10	1358	Mar 22 Wednesday
82	19	9	19	11	13	8	6	15	13	26	36	32	37	24	10	11	19	13	14	14	7	15	15	12	398	Mar 23 Thursday
83	11	14	11	9	11	18	10	11	13	19	26	24	41	20	18	21	22	29	59	73	117	126	131	144	978	Mar 24 Friday
84	136	144	129	121	64	42	65	49	77	98	90	78	45	17	25	5	14	16	14	12	28	4	19	10	1302	Mar 25 Saturday
85	17	4	24	16	21	12	12	5	14	10	12	11	5	7	7	9	23	6	13	11	15	8	12	11	285	Mar 26 Sunday
86	0	4	6	12	17	9	8	6	11	13	13	8	12	17	7	25	13	7	11	14	5	14	9	12	253	Mar 27 Monday
87	6	0	4	6	10	13	8	8	20	10	21	24	9	10	17	9	16	20	20	8	11	12	17	18	297	Mar 28 Tuesday
88	19	2	10	6	15	9	7	4	5	22	7	6	6	11	15	9	17	20	35	41	38	52	61	81	498	Mar 29 Wednesday
89	80	62	50	30	28	38	51	42	62	64	52	45	41	15	5	14	8	10	14	20	11	19	29	27	817	Mar 30 Thursday
90	16	26	17	17	22	22	12	23	13	15	19	13	24	19	23	8	27	14	14	14	10	14	29	18	429	Mar 31 Friday

ARC 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Sum 3050 2920 3233 3129 3351 4013 3859 3623 3190 3278 3406 4133
3988 2898 3179 3036 3267 3463 4447 3577 3868 3515 3542 3359 83324 Total sum

ARC	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
182	22	17	16	16	17	18	17	17	18	18	19	22	24	21	20	20	21	18	19	18	19	19	18	23	458	Total average
129	23	18	16	17	18	18	17	18	19	19	20	24	27	24	21	21	22	17	18	18	19	19	19	23	474	Average workdays
53	18	13	15	15	15	16	15	16	16	17	16	18	18	15	16	18	20	20	22	19	21	18	17	23	418	Average weekends

Table 3.5.2.(Page 4 of 4) Daily and hourly distribution of ARCESS detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

FIN .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
274	3	3	5	7	5	9	11	8	7	5	7	2	12	11	11	15	24	31	28	22	37	37	35	49	384	Oct 01 Saturday
275	30	32	23	13	8	2	9	15	13	16	12	18	12	10	24	29	9	5	13	7	5	4	7	5	321	Oct 02 Sunday
276	7	10	11	8	68	18	1	1	2	3	13	13	19	12	16	14	12	12	7	9	8	13	12	7	296	Oct 03 Monday
277	12	12	13	19	14	8	15	8	39	15	18	32	40	41	79	56	62	54	37	34	36	36	26	31	737	Oct 04 Tuesday
278	36	27	29	43	28	19	22	18	16	24	17	24	25	30	24	16	23	18	16	17	26	15	13	20	546	Oct 05 Wednesday
279	16	14	13	9	11	11	11	16	9	24	18	15	27	32	12	15	20	23	12	18	19	25	20	18	408	Oct 06 Thursday
280	19	10	14	20	16	14	17	4	9	9	11	26	30	18	6	15	12	19	13	15	8	12	13	10	340	Oct 07 Friday
281	13	9	7	6	10	11	6	7	6	10	11	3	11	7	2	4	9	5	8	9	10	10	7	2	183	Oct 08 Saturday
282	5	5	15	2	3	3	4	6	25	14	16	17	9	11	11	17	13	8	5	9	10	9	10	10	237	Oct 09 Sunday
283	11	7	10	9	8	6	6	11	14	12	11	18	18	18	8	8	7	3	5	7	4	10	9	5	225	Oct 10 Monday
284	4	6	9	9	6	11	9	13	29	13	7	12	10	12	8	8	5	3	10	6	10	8	4	4	216	Oct 11 Tuesday
285	5	6	7	10	6	10	20	6	10	14	27	20	22	15	13	7	12	12	6	8	12	7	5	5	265	Oct 12 Wednesday
286	6	7	10	9	8	5	3	7	2	11	3	16	24	16	10	12	13	7	10	5	5	6	4	8	207	Oct 13 Thursday
287	10	7	5	7	6	4	10	15	6	23	24	15	17	10	14	5	11	18	8	3	8	6	4	4	240	Oct 14 Friday
288	3	11	13	5	12	3	7	6	9	3	8	5	3	9	7	8	5	1	14	13	19	11	10	2	187	Oct 15 Saturday
289	7	7	0	2	6	10	4	2	3	3	9	3	5	10	3	5	2	5	11	2	7	10	10	7	133	Oct 16 Sunday
290	3	4	7	10	6	2	2	3	2	9	7	9	15	9	8	7	5	5	6	8	10	8	3	6	154	Oct 17 Monday
291	6	18	8	12	9	3	2	2	3	23	12	27	17	4	19	12	10	14	8	7	14	8	4	12	254	Oct 18 Tuesday
292	9	8	13	11	12	4	3	4	1	13	5	19	19	15	17	11	6	9	14	16	12	12	12	12	257	Oct 19 Wednesday
293	15	20	19	15	21	4	1	10	13	22	13	19	24	22	19	6	2	4	21	17	7	8	7	11	320	Oct 20 Thursday
294	26	19	14	13	6	8	8	6	7	16	16	37	16	14	28	5	10	7	15	13	19	8	8	6	325	Oct 21 Friday
295	12	12	10	15	9	4	4	16	5	5	13	8	30	23	10	14	6	7	0	3	2	1	2	2	213	Oct 22 Saturday
296	9	4	4	4	2	3	9	7	13	12	7	3	5	5	8	10	10	4	15	5	9	18	6	5	177	Oct 23 Sunday
297	10	8	10	14	8	6	2	6	14	7	8	11	20	10	16	7	10	6	1	8	7	4	5	5	203	Oct 24 Monday
298	5	17	10	7	14	2	7	11	11	11	14	14	13	16	12	9	5	8	7	6	9	2	16	8	234	Oct 25 Tuesday
299	6	7	15	17	4	4	9	9	6	7	12	11	12	19	14	10	5	6	7	2	4	2	3	9	200	Oct 26 Wednesday
300	14	6	15	9	4	1	1	7	5	17	7	10	22	17	6	10	6	9	3	5	10	10	10	7	211	Oct 27 Thursday
301	5	9	5	8	5	1	0	7	10	11	18	21	19	6	7	4	4	9	5	8	8	14	5	6	195	Oct 28 Friday
302	6	6	6	5	4	2	5	5	8	11	6	8	7	3	10	4	3	11	2	1	5	3	7	2	130	Oct 29 Saturday
303	11	5	4	6	2	5	7	4	11	8	3	7	5	4	4	2	6	4	12	8	9	10	7	6	150	Oct 30 Sunday
304	14	11	3	9	6	1	4	2	1	9	5	19	15	21	14	5	11	5	3	8	10	10	10	11	207	Oct 31 Monday
305	11	6	7	8	5	0	1	5	3	9	15	12	14	11	10	9	5	7	5	7	5	6	8	12	181	Nov 01 Tuesday
306	15	7	12	10	5	2	4	6	6	12	12	16	26	21	12	6	2	5	6	13	4	8	14	13	237	Nov 02 Wednesday
307	15	7	9	12	8	2	5	4	9	20	15	15	12	12	13	8	5	6	8	6	7	9	4	9	220	Nov 03 Thursday
308	7	20	15	10	4	4	6	6	12	9	19	18	35	33	18	3	7	6	11	4	2	1	1	4	255	Nov 04 Friday
309	1	2	17	9	9	12	6	9	14	16	14	10	7	13	13	16	13	25	19	12	7	5	9	1	259	Nov 05 Saturday
310	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	12	5	8	13	13	6	67	Nov 06 Sunday
311	9	13	14	13	12	15	13	2	8	5	10	3	11	9	15	5	6	3	7	13	4	6	11	6	213	Nov 07 Monday
312	3	10	10	5	5	3	1	1	1	11	9	12	18	31	22	22	81	32	8	5	5	6	4	4	309	Nov 08 Tuesday
313	8	4	7	6	8	3	14	15	33	36	45	34	24	15	34	10	8	0	6	8	3	12	6	8	347	Nov 09 Wednesday
314	5	7	5	11	4	5	2	18	14	13	16	9	26	14	18	6	7	1	5	6	3	9	12	5	221	Nov 10 Thursday
315	7	8	4	2	4	6	0	4	1	12	20	12	23	15	4	3	2	4	10	19	17	30	8	15	230	Nov 11 Friday
316	10	7	6	6	6	4	3	30	25	5	17	12	26	13	6	2	3	0	2	2	4	3	10	52	254	Nov 12 Saturday
317	64	0	0	0	0	13	3	8	9	6	5	1	3	5	2	4	0	3	9	11	23	19	11	6	205	Nov 13 Sunday
318	3	24	91	9	3	2	2	2	9	5	5	14	18	8	6	5	3	5	3	7	4	7	3	5	243	Nov 14 Monday
319	9	2	7	8	1	2	3	3	1	1	5	16	17	18	14	3	5	1	1	8	12	6	5	7	155	Nov 15 Tuesday
320	5	4	8	3	8	1	3	1	4	10	7	7	23	21	12	5	13	9	21	6	5	8	2	12	198	Nov 16 Wednesday
321	12	6	11	5	13	3	2	3	3	25	15	14	23	6	20	23	10	17	11	75	48	26	11	11	393	Nov 17 Thursday
322	32	47	11	84	58	35	14	1	16	16	15	14	22	13	3	4	4	8	20	13	7	2	6	7	452	Nov 18 Friday
323	9	4	4	12	8	3	6	13	46	27	16	8	9	8	3	7	44	52	37	1	4	15	44	12	392	Nov 19 Saturday
324	3	10	2	11	3	6	1	2	4	6	3	6	2	4	11	1	9	7	8	7	5	8	4	4	127	Nov 20 Sunday
325	7	11	4	12	5	2	1	4	6	12	3	12	9	14	9	4	1	6	3	9	11	6	8	12	171	Nov 21 Monday
326	4	12	12	17	16	27	23	0	6	6	8	10	30	12	3	5	4	10	3	5	4	3	4	18	242	Nov 22 Tuesday
327	9	7	8	2	4	4	2	3	8	13	17	17	27	12	8	2	3	3	3	6	7	6	6	3	180	Nov 23 Wednesday
328	13	12	31	42	39	34	34	15	8	14	8	17	10	15	3	4	5	2	10	12	11	8	7	10	364	Nov 24 Thursday
329	10	7	13	12	3	7	4	7	11	18	14	19	20	27	33	38	52	28	49	75	47	71	36	43	644	Nov 25 Friday

Table 3.5.3 (Page 1 of 4)

FIN .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date	
330	78	66	72	100	128	142	119	85	17	31	39	31	57	21	6	10	2	11	15	11	9	1	4	4	1059	Nov 26	Saturday
331	1	3	0	6	1	0	3	12	5	35	7	20	3	8	4	2	6	4	9	10	9	10	2	5	165	Nov 27	Sunday
332	3	20	29	3	4	7	8	6	6	9	18	10	19	5	4	2	6	4	10	7	9	36	38	37	300	Nov 28	Monday
333	9	5	7	28	9	1	2	3	9	10	11	17	26	9	7	6	6	9	6	27	21	11	11	25	275	Nov 29	Tuesday
334	37	48	29	3	18	30	21	18	15	9	7	15	21	38	49	42	46	33	38	22	30	12	9	20	610	Nov 30	Wednesday
335	4	5	5	12	8	1	7	8	7	6	17	30	25	6	5	5	2	4	6	16	2	4	3	5	193	Dec 01	Thursday
336	9	11	4	13	12	17	11	19	15	17	9	32	33	24	28	26	31	20	25	13	6	11	6	8	400	Dec 02	Friday
337	10	8	3	44	7	8	4	14	20	12	7	1	4	0	6	6	5	3	6	3	4	1	3	5	184	Dec 03	Saturday
338	3	4	0	4	3	20	6	5	4	2	3	4	9	2	6	3	5	7	5	4	4	9	5	9	126	Dec 04	Sunday
339	7	3	13	10	3	7	1	4	2	12	7	15	12	11	5	5	7	4	3	7	3	8	6	5	160	Dec 05	Monday
340	8	3	6	5	2	3	6	2	19	15	12	8	16	5	1	4	5	3	3	2	5	5	3	6	147	Dec 06	Tuesday
341	2	7	10	10	3	1	1	3	5	10	11	8	22	9	9	2	2	1	1	1	7	4	2	3	134	Dec 07	Wednesday
342	10	8	2	9	0	6	0	2	7	15	12	18	21	14	4	4	7	0	5	3	8	9	6	6	176	Dec 08	Thursday
343	8	6	3	5	4	2	1	4	6	11	17	22	22	8	4	3	6	7	8	6	6	4	11	10	184	Dec 09	Friday
344	9	11	12	7	7	4	3	5	8	11	6	9	6	9	6	2	6	7	6	4	2	6	1	4	151	Dec 10	Saturday
345	4	6	8	8	2	7	6	4	2	15	2	2	1	7	9	10	3	8	3	8	7	6	5	8	141	Dec 11	Sunday
346	4	7	5	4	5	2	3	2	6	13	2	5	17	10	11	10	9	0	0	0	3	8	4	9	139	Dec 12	Monday
347	4	11	5	6	2	0	2	5	7	8	18	19	20	9	7	6	4	4	3	3	4	7	7	22	183	Dec 13	Tuesday
348	15	7	6	3	6	4	2	4	7	9	15	12	22	12	1	0	9	2	1	6	13	5	6	7	174	Dec 14	Wednesday
349	6	7	11	7	3	4	3	2	2	8	10	25	12	8	6	5	6	11	7	10	11	10	6	9	189	Dec 15	Thursday
350	11	11	8	9	6	8	5	12	23	28	31	25	50	40	21	31	14	22	21	34	22	12	13	40	497	Dec 16	Friday
351	3	0	0	0	0	0	0	0	0	0	0	0	6	44	51	71	70	80	71	94	66	19	3	5	583	Dec 17	Saturday
352	1	4	11	7	18	6	2	1	10	6	17	14	4	8	11	4	3	5	7	5	12	13	4	3	176	Dec 18	Sunday
353	7	7	7	6	5	3	1	4	2	4	9	15	19	6	9	5	3	5	2	5	7	11	7	7	156	Dec 19	Monday
354	6	3	4	4	4	5	5	3	7	7	14	19	13	10	6	4	5	7	1	3	8	4	3	6	151	Dec 20	Tuesday
355	6	1	4	5	3	2	3	5	7	25	27	16	25	18	8	6	3	2	4	5	3	0	0	0	178	Dec 21	Wednesday
356	0	0	0	0	0	0	3	6	9	8	10	6	26	20	9	1	7	2	3	3	6	8	9	9	145	Dec 22	Thursday
357	6	3	5	2	3	2	5	3	9	9	13	16	13	0	1	2	3	5	3	1	4	4	1	8	121	Dec 23	Friday
358	4	2	6	3	0	4	2	2	1	7	8	6	5	8	6	10	4	2	3	1	2	0	1	1	88	Dec 24	Saturday
359	1	2	3	5	5	2	1	6	7	1	1	0	4	2	1	3	0	0	0	1	3	5	12	11	76	Dec 25	Sunday
360	11	16	5	8	9	9	3	14	4	9	15	9	8	10	14	6	10	13	14	9	6	0	0	1	203	Dec 26	Monday
361	1	12	8	5	6	1	1	4	2	3	8	11	6	18	6	4	2	7	1	7	8	3	7	8	139	Dec 27	Tuesday
362	6	7	10	4	5	2	1	3	5	9	10	19	50	29	10	11	7	8	10	2	8	16	22	16	270	Dec 28	Wednesday
363	7	6	7	4	5	7	5	6	5	12	16	13	22	21	9	14	7	4	10	7	3	3	14	7	214	Dec 29	Thursday
364	8	5	7	7	1	2	5	3	5	8	15	21	14	8	5	4	5	7	8	2	8	8	5	6	167	Dec 30	Friday
365	2	3	4	13	1	1	2	7	10	7	0	4	0	2	11	0	1	8	1	2	2	5	1	4	91	Dec 31	Saturday
1	8	0	4	4	2	3	1	56	36	10	2	3	11	3	4	2	3	7	10	6	9	7	16	4	211	Jan 01	Sunday
2	6	8	11	5	1	3	0	5	2	5	2	12	19	10	6	9	11	7	10	8	17	20	16	15	208	Jan 02	Monday
3	14	25	24	21	22	6	11	24	32	29	26	23	30	48	38	34	34	55	61	47	37	21	17	9	688	Jan 03	Tuesday
4	12	28	17	23	20	13	10	14	18	20	20	21	24	6	6	10	4	4	1	4	4	5	3	11	298	Jan 04	Wednesday
5	5	9	7	3	1	1	5	9	7	22	13	13	28	9	8	3	11	16	24	18	12	3	8	11	246	Jan 05	Thursday
6	10	6	3	8	10	8	3	6	9	14	17	4	23	5	3	1	8	7	14	18	35	27	39	33	311	Jan 06	Friday
7	54	50	50	69	60	61	61	47	26	36	21	14	18	17	12	9	7	8	5	8	8	5	2	1	649	Jan 07	Saturday
8	4	2	6	7	4	3	8	4	7	9	2	5	3	3	8	3	3	4	7	4	4	3	1	7	111	Jan 08	Sunday
9	8	7	5	5	4	0	2	1	3	3	3	8	14	4	1	2	6	2	7	9	9	4	10	3	120	Jan 09	Monday
10	8	8	9	7	3	3	0	1	7	5	14	19	21	9	8	5	3	5	6	5	8	4	7	0	165	Jan 10	Tuesday
11	4	5	5	4	1	2	3	5	5	8	9	11	14	15	6	8	7	7	2	3	8	5	4	4	145	Jan 11	Wednesday
12	6	4	5	9	3	2	2	1	8	8	9	23	16	16	12	4	7	6	3	5	8	6	5	10	178	Jan 12	Thursday
13	3	6	3	9	5	5	5	5	9	19	11	14	15	11	2	11	4	9	4	13	14	17	16	24	234	Jan 13	Friday
14	28	37	24	29	23	16	9	8	4	7	2	8	14	3	3	7	3	4	0	6	5	4	5	6	255	Jan 14	Saturday
15	1	5	8	2	9	6	4	6	1	4	5	1	4	3	0	5	6	7	8	11	8	6	5	9	124	Jan 15	Sunday
16	18	7	7	12	16	9	12	11	9	6	14	18	14	5	13	4	4	7	13	9	4	11	4	11	238	Jan 16	Monday
17	7	9	4	11	3	2	4	3	6	9	5	20	17	17	11	6	4	9	7	8	12	6	8	3	191	Jan 17	Tuesday
18	12	9	4	6	3	5	5	9	7	10	12	17	15	23	17	4	10	14	15	24	40	44	42	50	397	Jan 18	Wednesday
19	31	34	47	36	34	37	33	33	23	11	15	11	10	14	11	17	16	8	12	8	7	18	19	41	526	Jan 19	Thursday
20	37	32	7	9	4	7	2	6	10	8	15	21	26	14	16	5	13	21	29	47	45	47	55	58	534	Jan 20	Friday

Table 3.5.3 (Page 2 of 4)

FIN .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
21	60	26	13	10	24	55	35	40	13	7	11	8	15	4	6	5	14	13	13	41	61	60	79	82	695	Jan 21 Saturday
22	79	63	46	44	60	21	14	9	10	7	10	5	4	2	8	4	4	6	14	10	12	4	10	7	453	Jan 22 Sunday
23	6	7	7	4	10	5	8	10	7	14	12	10	18	18	18	5	7	3	9	11	11	4	10	6	220	Jan 23 Monday
24	2	4	5	5	1	5	8	7	9	15	11	15	22	13	9	11	13	9	14	10	8	9	6	7	218	Jan 24 Tuesday
25	7	3	4	7	7	4	2	3	2	10	14	14	23	13	26	6	3	11	9	13	6	5	2	6	200	Jan 25 Wednesday
26	3	3	4	1	4	6	7	6	6	11	9	16	25	14	15	5	4	1	4	7	6	5	7	4	173	Jan 26 Thursday
27	7	8	11	6	9	4	4	6	8	17	21	17	19	15	14	7	8	8	6	7	15	9	2	5	233	Jan 27 Friday
28	6	3	10	4	7	11	8	4	5	8	8	13	10	1	6	2	2	8	3	8	7	3	4	5	146	Jan 28 Saturday
29	7	3	5	7	12	8	6	5	7	7	3	4	6	11	4	8	1	6	9	5	9	7	6	3	149	Jan 29 Sunday
30	5	6	9	6	5	4	5	4	7	11	9	11	25	16	13	12	8	9	9	10	5	6	17	5	217	Jan 30 Monday
31	8	3	9	12	6	8	8	10	6	10	7	0	0	0	1	24	14	18	12	19	25	32	51	47	330	Jan 31 Tuesday
32	34	25	19	16	15	14	8	11	10	11	15	9	24	21	19	8	6	10	7	6	8	10	5	3	314	Feb 01 Wednesday
33	8	8	2	3	1	7	3	7	10	14	10	13	30	19	14	6	4	8	8	11	5	12	2	5	210	Feb 02 Thursday
34	12	4	6	6	3	5	2	7	8	13	16	12	19	16	13	12	7	4	9	13	3	8	10	0	208	Feb 03 Friday
35	8	1	3	4	10	5	2	3	5	9	4	5	11	5	5	5	5	3	6	6	3	2	1	3	114	Feb 04 Saturday
36	4	1	2	3	3	8	3	6	6	1	7	2	3	6	2	6	3	5	7	15	12	4	9	48	166	Feb 05 Sunday
37	33	20	16	18	12	9	14	12	9	12	22	24	33	19	17	14	21	15	8	8	9	5	9	9	368	Feb 06 Monday
38	6	9	9	15	11	8	5	9	8	12	15	17	21	14	14	9	10	12	10	14	8	12	16	20	284	Feb 07 Tuesday
39	18	20	22	15	18	13	11	15	23	14	19	26	21	20	14	7	10	7	6	17	5	8	6	4	339	Feb 08 Wednesday
40	7	9	12	8	11	7	6	2	11	15	14	34	31	18	19	9	9	9	4	10	2	10	9	12	278	Feb 09 Thursday
41	6	8	23	9	5	7	6	4	17	17	15	10	23	11	16	3	9	11	9	14	7	3	13	9	255	Feb 10 Friday
42	4	6	8	9	5	9	5	6	3	8	12	8	10	12	4	16	11	7	8	3	3	4	0	7	168	Feb 11 Saturday
43	2	10	3	23	6	4	8	6	20	12	6	5	8	10	5	12	13	14	9	14	11	6	11	4	222	Feb 12 Sunday
44	11	13	14	10	8	5	5	9	20	19	16	9	26	15	14	16	6	8	3	5	9	6	4	7	258	Feb 13 Monday
45	11	17	7	10	6	7	9	10	6	10	14	19	24	21	19	8	12	8	10	10	10	4	6	2	260	Feb 14 Tuesday
46	13	11	14	5	8	5	4	9	17	10	29	22	13	11	9	10	12	10	11	4	12	11	10	11	271	Feb 15 Wednesday
47	5	4	9	5	5	5	7	5	12	8	13	13	14	17	21	12	7	3	6	8	8	6	14	7	214	Feb 16 Thursday
48	6	10	6	5	5	2	11	5	7	11	11	14	33	20	18	6	6	4	9	15	10	10	8	6	238	Feb 17 Friday
49	10	5	2	6	11	11	8	6	4	9	6	4	7	10	6	7	2	8	0	10	5	5	2	5	149	Feb 18 Saturday
50	7	2	4	3	8	5	2	1	2	0	3	3	3	4	4	3	8	7	8	7	2	4	7	8	105	Feb 19 Sunday
51	16	14	5	3	4	3	7	7	15	6	11	13	20	22	7	8	11	6	13	8	6	4	7	7	223	Feb 20 Monday
52	1	8	8	5	8	2	3	5	7	11	20	11	20	12	3	3	6	7	8	6	6	8	2	9	179	Feb 21 Tuesday
53	7	7	6	11	6	4	3	2	6	8	16	14	24	11	15	12	8	6	6	9	6	7	3	3	200	Feb 22 Wednesday
54	7	7	9	6	9	14	3	6	10	12	13	19	17	18	16	13	9	5	3	10	7	14	7	4	238	Feb 23 Thursday
55	7	6	7	5	3	5	9	6	4	12	23	14	12	12	7	8	4	5	5	6	10	3	5	0	178	Feb 24 Friday
56	4	6	6	6	6	4	3	8	2	14	8	11	6	6	8	6	9	11	4	9	4	3	17	2	163	Feb 25 Saturday
57	6	3	4	9	8	13	6	2	11	3	4	5	8	1	5	8	1	5	13	8	11	9	9	8	160	Feb 26 Sunday
58	17	14	6	4	13	3	6	7	8	9	9	10	18	24	4	9	3	9	10	16	4	5	6	8	222	Feb 27 Monday
59	5	5	10	6	6	6	4	5	4	7	20	19	27	5	10	11	9	1	7	7	4	4	7	4	193	Feb 28 Tuesday
60	5	8	7	2	3	6	0	6	10	9	16	20	22	8	22	7	6	10	6	6	10	7	3	5	204	Mar 01 Wednesday
61	3	6	7	1	1	8	4	3	12	5	18	15	17	9	14	5	6	4	4	9	10	3	8	8	180	Mar 02 Thursday
62	5	4	2	6	1	3	1	3	8	6	11	14	40	18	17	3	3	9	13	2	6	5	12	2	194	Mar 03 Friday
63	5	12	4	12	7	2	4	6	6	5	11	6	4	8	7	5	1	6	7	1	2	3	6	1	131	Mar 04 Saturday
64	2	3	2	5	4	0	6	5	0	4	5	4	1	6	6	8	3	2	8	7	10	11	15	14	131	Mar 05 Sunday
65	23	20	14	14	12	5	13	8	6	7	9	12	26	12	16	15	13	8	11	8	5	5	3	8	273	Mar 06 Monday
66	3	6	8	3	11	7	1	2	8	9	16	23	14	16	20	8	6	8	6	9	7	6	8	9	214	Mar 07 Tuesday
67	11	5	8	11	7	3	4	5	9	9	11	11	20	6	12	10	9	12	5	13	3	13	14	9	220	Mar 08 Wednesday
68	9	9	10	6	8	4	6	9	8	8	10	18	9	8	10	10	10	2	14	6	6	5	4	3	192	Mar 09 Thursday
69	4	10	2	3	8	5	2	2	7	13	12	18	20	11	9	10	10	6	6	2	6	2	7	6	181	Mar 10 Friday
70	6	7	8	5	3	13	3	8	10	7	2	4	3	8	7	10	7	5	2	7	8	4	4	2	143	Mar 11 Saturday
71	2	0	0	1	6	3	7	1	4	3	5	3	4	0	3	2	8	5	8	7	11	7	1	7	98	Mar 12 Sunday
72	8	12	9	4	3	4	2	6	7	10	10	7	26	8	15	8	5	9	7	2	6	7	9	8	192	Mar 13 Monday
73	6	5	8	8	8	7	13	3	8	13	13	9	29	15	8	12	11	10	16	9	12	15	23	21	282	Mar 14 Tuesday
74	26	14	21	24	14	7	7	3	11	18	15	20	28	14	5	10	10	6	6	5	10	7	9	6	296	Mar 15 Wednesday
75	8	16	8	14	10	6	5	3	7	12	11	21	18	19	15	9	14	8	4	5	4	6	1	4	228	Mar 16 Thursday
76	9	5	4	6	3	3	2	5	6	19	17	18	16	7	9	9	7	6	13	12	5	12	6	9	208	Mar 17 Friday

Table 3.5.3 (Page 3 of 4)

FIN .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
77	11	6	4	5	3	10	4	11	5	10	3	13	9	5	6	7	6	4	6	0	0	0	0	0	128	Mar 18 Saturday
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	16	10	30	Mar 19 Sunday
79	14	7	7	4	12	3	4	1	9	4	10	15	20	14	12	9	7	7	6	10	12	10	6	9	212	Mar 20 Monday
80	8	10	1	2	2	3	3	6	6	15	14	21	10	11	15	8	8	4	6	3	5	8	5	11	185	Mar 21 Tuesday
81	5	5	7	5	5	4	5	5	3	21	11	16	10	8	16	10	10	4	9	9	12	12	9	15	216	Mar 22 Wednesday
82	8	9	15	10	5	5	1	1	6	12	22	18	13	14	9	3	6	4	4	4	5	7	8	5	194	Mar 23 Thursday
83	10	9	7	4	6	1	2	9	12	23	8	19	18	10	3	3	7	2	4	7	3	5	6	5	183	Mar 24 Friday
84	8	6	4	6	6	4	1	5	11	3	12	7	6	2	12	5	3	6	3	4	9	2	6	10	141	Mar 25 Saturday
85	5	24	26	23	14	19	26	24	18	20	19	20	28	22	18	23	17	29	27	24	21	25	23	21	516	Mar 26 Sunday
86	28	16	23	23	23	13	13	19	17	15	21	25	30	20	13	28	20	17	17	22	22	24	28	20	497	Mar 27 Monday
87	15	29	21	15	21	22	19	19	22	21	18	6	12	10	7	6	7	6	10	8	8	8	13	10	333	Mar 28 Tuesday
88	8	8	11	11	9	6	7	9	12	13	15	23	15	19	10	11	12	11	5	14	16	8	16	18	287	Mar 29 Wednesday
89	17	11	13	15	14	13	12	14	17	28	19	24	16	25	19	20	20	22	19	16	23	26	28	31	462	Mar 30 Thursday
90	25	32	34	27	28	19	25	16	18	22	23	14	13	15	15	17	19	11	16	14	19	18	23	19	482	Mar 31 Friday
FIN	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum	1982	1897	1882	1917	1719	1448	1292	1464	1717	2119	2206	2479	3122	2352	2073	1671	1706	1663	1753	1914	1894	1797	1802	1951	45820	Total sum
182	11	10	10	11	9	8	7	8	9	12	12	14	17	13	11	9	9	9	10	11	10	10	10	11	252	Total average
129	10	11	11	10	9	7	6	7	9	13	14	16	21	15	13	9	10	9	9	11	10	10	10	11	260	Average workdays
53	12	10	9	11	11	11	9	11	9	9	8	7	8	8	8	8	8	9	10	9	10	8	9	10	223	Average weekends

Table 3.5.3. (Page 4 of 4) Daily and hourly distribution of FINESS detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

GER .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
274	4	10	5	1	1	6	2	10	4	13	23	4	9	7	12	6	6	14	22	3	6	8	6	3	185	Oct 01 Saturday
275	7	5	1	5	0	5	8	7	6	9	19	7	10	13	1	2	13	3	2	1	6	2	14	3	149	Oct 02 Sunday
276	3	2	3	10	2	5	5	2	2	12	5	17	28	16	4	13	2	1	3	3	4	1	4	6	153	Oct 03 Monday
277	2	4	5	5	5	8	8	10	24	28	30	26	26	49	44	38	38	31	27	16	15	19	15	16	489	Oct 04 Tuesday
278	27	18	10	13	21	26	13	16	22	29	28	21	19	27	22	21	13	6	8	4	12	14	6	6	402	Oct 05 Wednesday
279	4	6	10	7	8	11	15	16	6	20	26	15	25	17	12	14	18	3	9	2	3	6	6	8	267	Oct 06 Thursday
280	6	4	8	15	6	2	5	18	10	11	32	25	18	19	8	15	2	9	13	3	1	9	3	2	244	Oct 07 Friday
281	2	0	2	1	5	11	5	7	5	12	15	5	7	24	15	3	0	2	2	2	2	6	13	3	149	Oct 08 Saturday
282	3	0	2	5	3	1	0	3	18	12	1	23	9	3	10	5	16	5	4	3	4	4	9	14	157	Oct 09 Sunday
283	5	3	4	9	3	2	2	7	16	17	24	15	0	7	27	10	14	5	10	5	1	10	7	4	207	Oct 10 Monday
284	7	4	8	6	0	6	4	14	16	13	26	26	33	28	25	11	27	6	3	1	8	4	4	10	290	Oct 11 Tuesday
285	2	8	6	7	8	10	17	5	22	9	6	36	30	23	25	19	17	11	2	1	2	3	3	11	283	Oct 12 Wednesday
286	10	5	3	13	24	17	0	6	20	24	19	38	36	27	18	9	14	18	6	3	12	3	7	6	338	Oct 13 Thursday
287	7	4	9	8	2	0	2	18	15	23	29	40	25	8	13	5	2	9	3	17	13	3	1	2	258	Oct 14 Friday
288	14	12	4	7	3	8	1	8	5	1	8	12	8	8	9	15	5	2	1	1	5	2	10	0	149	Oct 15 Saturday
289	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	Oct 16 Sunday
290	0	0	0	0	0	0	0	5	13	22	35	30	25	13	22	10	8	4	3	5	4	3	1	3	206	Oct 17 Monday
291	2	3	7	6	2	8	8	12	14	18	38	32	14	20	10	34	11	5	10	6	3	3	2	8	276	Oct 18 Tuesday
292	2	2	5	5	3	7	9	10	9	36	16	38	29	12	7	16	18	4	15	6	0	3	9	7	268	Oct 19 Wednesday
293	6	15	3	5	3	1	0	9	11	16	16	41	16	39	18	17	3	7	7	12	15	10	10	4	284	Oct 20 Thursday
294	3	3	2	4	8	18	8	18	20	16	46	47	48	31	20	27	27	8	9	14	9	4	4	6	400	Oct 21 Friday
295	2	1	2	7	19	9	12	9	15	15	22	1	9	4	3	4	2	3	3	1	3	1	6	3	156	Oct 22 Saturday
296	2	3	2	0	2	5	3	0	7	0	13	4	7	3	1	3	0	0	1	5	4	3	1	3	72	Oct 23 Sunday
297	7	9	5	7	2	15	7	12	15	16	18	33	22	8	14	20	6	8	3	8	4	2	9	8	258	Oct 24 Monday
298	3	16	2	1	3	3	9	11	13	12	28	27	28	23	10	18	29	5	3	9	14	6	3	4	280	Oct 25 Tuesday
299	8	4	7	17	4	12	7	7	15	16	18	46	22	18	16	9	13	8	7	7	6	9	4	4	284	Oct 26 Wednesday
300	2	12	14	8	6	9	9	14	20	12	30	39	18	16	5	6	10	18	0	0	0	0	0	0	248	Oct 27 Thursday
301	0	0	0	0	0	0	0	0	0	0	0	0	0	10	9	8	1	10	8	8	4	9	7	6	80	Oct 28 Friday
302	9	4	5	7	9	6	4	3	5	0	21	8	7	6	6	2	10	2	9	8	4	6	7	8	156	Oct 29 Saturday
303	7	10	8	15	11	25	11	11	13	17	27	16	23	10	11	17	12	24	12	12	13	25	14	14	358	Oct 30 Sunday
304	16	24	20	12	28	21	16	26	20	25	35	38	38	37	2	0	0	0	0	0	0	0	0	14	372	Oct 31 Monday
305	4	1	0	5	3	4	2	2	12	13	12	29	17	10	2	6	5	3	1	3	0	8	3	1	146	Nov 01 Tuesday
306	23	5	7	5	3	4	1	16	9	12	19	21	18	19	13	11	4	5	5	2	0	6	3	4	215	Nov 02 Wednesday
307	10	1	3	9	3	0	7	24	16	18	11	19	20	21	12	7	15	7	5	2	6	2	8	6	232	Nov 03 Thursday
308	3	14	8	8	7	2	3	4	14	21	30	25	32	10	13	4	5	8	5	5	3	4	4	5	237	Nov 04 Friday
309	11	5	9	7	1	4	5	7	6	1	15	7	9	5	6	5	12	4	5	3	1	2	2	4	136	Nov 05 Saturday
310	3	1	3	1	4	1	4	1	1	2	2	8	6	8	10	2	2	2	0	3	2	1	9	4	80	Nov 06 Sunday
311	10	3	6	2	0	3	6	2	6	22	21	29	14	13	16	15	9	6	2	5	5	6	5	5	211	Nov 07 Monday
312	4	2	1	2	7	23	3	2	10	24	14	19	36	6	13	15	16	3	1	7	4	4	1	1	218	Nov 08 Tuesday
313	3	3	1	10	7	5	13	6	13	13	35	26	29	12	16	9	8	7	9	2	10	6	1	6	250	Nov 09 Wednesday
314	5	12	1	6	3	4	6	14	15	13	32	24	27	11	12	21	9	5	5	1	4	4	4	5	243	Nov 10 Thursday
315	2	2	3	8	4	2	1	10	10	17	14	21	29	15	11	3	3	5	2	4	6	3	3	1	179	Nov 11 Friday
316	1	6	2	3	4	5	2	2	2	2	17	5	6	3	5	1	4	0	3	3	6	5	0	2	89	Nov 12 Saturday
317	3	6	2	2	2	3	3	6	9	3	5	1	7	3	1	3	2	2	3	5	13	4	7	3	98	Nov 13 Sunday
318	1	6	8	38	6	2	2	4	5	9	18	15	15	14	11	15	5	1	2	7	2	10	9	1	206	Nov 14 Monday
319	3	2	7	7	7	2	5	21	9	13	18	27	25	20	11	23	10	5	9	6	11	4	3	3	251	Nov 15 Tuesday
320	5	2	4	3	7	0	1	6	5	15	17	14	19	5	13	1	4	5	1	1	2	7	7	4	148	Nov 16 Wednesday
321	7	4	4	15	4	3	0	7	6	11	22	43	12	14	14	7	12	5	3	2	2	2	3	3	205	Nov 17 Thursday
322	3	6	3	4	1	5	3	13	9	17	25	26	18	15	11	7	8	6	2	6	8	0	5	9	210	Nov 18 Friday
323	7	3	10	2	6	0	7	1	5	3	2	4	13	8	6	5	1	5	0	3	2	2	3	2	100	Nov 19 Saturday
324	4	5	0	8	1	1	7	1	5	10	5	4	0	2	5	0	3	5	4	0	5	3	6	6	90	Nov 20 Sunday
325	6	4	11	0	0	1	5	10	12	16	23	19	27	6	6	16	8	4	0	3	3	5	7	2	194	Nov 21 Monday
326	4	3	12	8	8	12	2	11	11	6	21	20	27	13	15	15	5	3	4	5	5	7	2	5	224	Nov 22 Tuesday
327	1	5	8	1	5	4	3	8	17	18	17	20	20	11	11	17	3	1	5	5	5	5	1	1	192	Nov 23 Wednesday
328	4	3	6	5	2	0	3	6	12	15	33	18	20	16	11	11	5	0	12	2	5	4	4	3	200	Nov 24 Thursday
329	3	4	6	1	5	5	0	11	12	23	25	20	6	11	6	6	6	1	0	2	6	5	6	5	175	Nov 25 Friday

Table 3.5.4 (Page 1 of 4)

GER .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
330	3	6	3	5	4	4	8	1	0	3	9	8	6	4	0	5	2	5	0	0	1	0	0	0	77	Nov 26 Saturday
331	1	3	4	2	0	1	6	2	3	2	1	3	2	12	1	3	2	3	7	0	0	5	2	3	68	Nov 27 Sunday
332	2	5	6	2	4	4	5	10	3	4	20	14	18	15	22	12	11	1	5	2	5	0	3	3	176	Nov 28 Monday
333	5	4	1	8	5	0	0	8	12	18	15	12	36	15	17	11	3	3	0	1	13	0	1	2	190	Nov 29 Tuesday
334	1	6	9	3	1	5	5	5	11	6	10	22	20	17	13	16	9	1	7	9	6	2	3	4	191	Nov 30 Wednesday
335	6	0	1	4	6	2	12	16	6	17	24	32	29	9	28	18	8	4	1	3	2	5	10	1	244	Dec 01 Thursday
336	7	2	3	5	5	1	2	3	11	12	19	24	22	19	18	7	2	5	4	5	4	3	3	2	188	Dec 02 Friday
337	4	4	5	1	6	5	8	0	2	7	12	5	15	6	10	5	8	3	2	0	2	3	1	3	117	Dec 03 Saturday
338	4	1	0	0	1	4	4	1	9	5	6	5	8	1	23	2	2	16	5	5	2	12	7	12	135	Dec 04 Sunday
339	15	4	8	12	7	8	0	4	8	7	9	16	13	19	6	3	9	1	4	9	4	9	10	2	187	Dec 05 Monday
340	1	7	3	2	4	3	3	7	5	13	21	21	21	15	16	9	4	5	4	1	4	3	2	4	178	Dec 06 Tuesday
341	1	2	0	7	1	1	0	3	10	14	18	22	19	11	16	6	1	2	1	0	3	2	4	0	144	Dec 07 Wednesday
342	1	6	2	7	3	13	5	6	12	9	20	27	25	24	12	12	6	8	13	10	11	5	3	2	242	Dec 08 Thursday
343	2	4	5	2	1	1	8	2	3	9	16	15	20	7	11	5	2	2	10	4	5	3	7	13	157	Dec 09 Friday
344	4	5	5	4	4	2	3	12	7	4	9	21	19	13	4	7	6	5	4	0	4	3	1	3	149	Dec 10 Saturday
345	2	3	3	4	2	2	3	0	1	11	1	2	2	2	0	0	3	3	2	8	1	5	6	5	71	Dec 11 Sunday
346	3	4	1	1	4	6	6	7	7	13	20	23	20	19	30	11	3	5	1	3	4	3	6	1	201	Dec 12 Monday
347	1	5	7	3	1	5	7	5	6	17	22	26	18	17	16	9	3	4	4	1	4	4	5	1	191	Dec 13 Tuesday
348	3	3	4	11	5	5	3	9	25	22	24	22	29	17	13	8	3	4	4	0	7	4	1	2	228	Dec 14 Wednesday
349	2	3	9	2	7	2	11	3	10	17	18	27	36	29	17	19	9	3	2	5	0	1	8	7	247	Dec 15 Thursday
350	3	4	3	5	4	6	1	5	3	6	12	11	20	5	13	5	0	6	4	2	2	3	2	4	129	Dec 16 Friday
351	1	2	1	3	4	7	10	9	1	5	7	11	1	4	2	1	10	0	4	3	4	3	2	2	97	Dec 17 Saturday
352	3	4	1	0	1	2	1	4	3	3	1	14	1	4	2	6	4	1	0	0	6	3	4	6	74	Dec 18 Sunday
353	6	1	10	4	2	8	2	4	7	13	14	8	7	9	6	8	4	2	4	3	3	0	0	1	126	Dec 19 Monday
354	5	4	2	3	8	6	2	4	4	16	9	11	12	14	12	23	4	2	1	1	1	5	0	1	150	Dec 20 Tuesday
355	2	1	1	0	0	1	2	4	3	22	9	17	19	16	9	2	7	4	1	2	5	3	4	3	137	Dec 21 Wednesday
356	2	5	0	4	3	0	3	1	16	11	14	11	10	12	6	2	6	3	5	0	2	7	3	4	130	Dec 22 Thursday
357	2	3	2	0	1	2	2	3	6	12	10	5	3	7	4	3	3	1	5	1	4	5	5	1	90	Dec 23 Friday
358	0	4	1	2	10	4	8	0	1	3	1	1	3	0	8	1	0	0	1	3	3	5	5	10	74	Dec 24 Saturday
359	8	3	3	4	4	1	4	10	5	4	5	2	6	2	0	6	1	4	4	9	2	2	1	3	93	Dec 25 Sunday
360	4	1	2	5	1	3	8	3	1	3	5	2	3	1	6	1	1	1	0	3	2	1	1	2	60	Dec 26 Monday
361	3	3	4	7	4	6	2	5	2	0	9	2	4	4	4	0	3	8	1	8	5	1	4	4	93	Dec 27 Tuesday
362	5	5	0	4	1	2	1	2	3	1	2	13	17	12	11	3	7	8	8	1	8	17	11	7	149	Dec 28 Wednesday
363	0	2	1	6	4	4	4	3	3	8	5	10	8	7	5	6	5	4	7	6	4	1	10	2	115	Dec 29 Thursday
364	4	5	1	2	5	0	8	3	3	6	4	4	5	7	8	5	3	3	6	1	0	3	0	6	92	Dec 30 Friday
365	1	2	1	5	4	4	3	4	15	6	9	4	4	8	15	6	4	3	2	3	3	7	1	1	115	Dec 31 Saturday
1	1	1	5	3	0	3	4	7	3	14	16	3	6	3	2	13	2	5	2	3	5	1	5	4	111	Jan 01 Sunday
2	7	2	6	5	2	1	2	2	2	9	2	6	15	5	7	3	3	1	6	1	6	13	4	1	111	Jan 02 Monday
3	2	7	1	3	5	2	4	6	11	5	11	16	7	10	2	2	5	3	4	3	7	2	6	1	125	Jan 03 Tuesday
4	7	1	8	4	3	4	3	1	6	11	6	7	19	5	3	6	5	1	1	5	1	1	6	5	119	Jan 04 Wednesday
5	4	6	2	3	20	8	1	1	0	7	13	8	20	13	2	2	0	4	4	7	7	1	1	8	142	Jan 05 Thursday
6	4	3	5	5	1	0	5	6	3	2	9	2	14	2	5	3	7	6	2	5	8	2	12	6	117	Jan 06 Friday
7	7	6	7	4	2	0	1	2	0	1	2	7	5	10	2	10	2	3	4	4	7	6	3	3	98	Jan 07 Saturday
8	2	4	6	0	5	4	1	2	1	5	8	10	4	3	2	0	0	0	3	0	0	2	10	1	73	Jan 08 Sunday
9	0	1	1	2	2	0	1	2	8	11	9	7	12	14	7	1	3	5	12	3	6	1	1	5	114	Jan 09 Monday
10	1	6	7	1	4	3	1	3	10	8	7	18	15	5	7	6	1	1	9	2	7	8	0	0	130	Jan 10 Tuesday
11	6	3	1	5	5	2	2	3	8	10	20	19	13	37	59	9	2	3	2	6	3	5	3	5	231	Jan 11 Wednesday
12	5	2	2	0	4	6	0	9	9	12	17	13	17	2	9	8	6	9	7	1	1	4	5	6	154	Jan 12 Thursday
13	2	1	5	6	6	7	4	0	13	4	9	13	21	7	5	8	1	3	2	5	0	7	2	1	132	Jan 13 Friday
14	1	5	4	2	5	1	1	7	13	1	1	7	15	6	1	0	1	3	2	4	2	0	2	1	85	Jan 14 Saturday
15	2	5	6	5	2	5	3	1	2	4	4	8	7	6	3	2	10	1	1	3	3	0	5	5	93	Jan 15 Sunday
16	6	3	6	7	6	4	5	7	5	21	34	27	29	14	6	4	25	38	9	3	6	11	4	2	282	Jan 16 Monday
17	3	2	1	5	2	1	5	2	6	17	13	35	26	14	13	7	1	12	12	4	4	3	4	1	193	Jan 17 Tuesday
18	6	9	0	1	3	2	1	8	7	10	12	19	21	13	8	10	4	4	4	6	5	0	3	2	158	Jan 18 Wednesday
19	1	7	9	4	2	4	5	0	5	6	13	13	22	8	8	18	1	4	3	4	1	7	3	2	150	Jan 19 Thursday
20	1	8	4	7	6	0	0	3	5	12	12	16	10	4	5	7	10	2	0	4	5	2	10	1	134	Jan 20 Friday

Table 3.5.4 (Page 2 of 4)

GER .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
21	3	4	2	4	2	0	4	14	5	11	3	5	26	11	2	3	2	0	2	2	2	6	1	3	117	Jan 21 Saturday
22	8	3	1	1	2	3	15	0	12	16	36	25	33	55	56	64	76	59	52	38	36	32	16	8	647	Jan 22 Sunday
23	7	5	7	6	6	5	4	2	4	1	7	6	12	15	4	2	2	8	1	6	2	1	2	4	119	Jan 23 Monday
24	1	2	5	1	6	4	2	7	3	6	9	20	11	18	6	4	8	2	7	5	5	6	3	3	144	Jan 24 Tuesday
25	0	3	0	2	2	4	2	2	2	1	9	9	20	7	5	5	6	0	5	2	5	1	6	3	101	Jan 25 Wednesday
26	3	3	2	1	6	7	0	6	6	5	12	9	8	12	14	6	1	2	0	1	1	27	1	22	155	Jan 26 Thursday
27	30	26	15	7	2	5	2	8	2	4	13	16	5	4	7	11	1	2	3	1	5	5	2	3	179	Jan 27 Friday
28	7	1	6	3	4	2	1	6	2	1	6	7	6	6	3	2	1	5	4	0	1	3	1	2	80	Jan 28 Saturday
29	5	5	6	3	3	5	1	2	2	1	3	28	12	5	6	1	2	5	3	1	6	3	0	2	110	Jan 29 Sunday
30	1	7	2	3	5	4	0	2	2	13	7	17	13	4	7	1	3	5	4	5	0	1	5	3	114	Jan 30 Monday
31	2	3	4	7	5	0	2	2	9	5	7	20	23	6	15	7	1	1	2	4	2	3	3	2	135	Jan 31 Tuesday
32	3	6	3	3	7	0	1	4	14	12	9	19	14	8	7	4	1	3	0	2	9	12	9	1	151	Feb 01 Wednesday
33	8	1	3	3	1	1	0	3	9	2	20	12	17	14	5	5	4	3	2	8	7	9	5	3	145	Feb 02 Thursday
34	7	4	8	8	3	6	4	2	4	5	13	27	25	3	4	11	10	2	0	2	2	0	7	2	159	Feb 03 Friday
35	4	1	1	0	0	4	2	1	2	1	6	4	11	6	0	4	6	8	2	2	3	1	4	1	74	Feb 04 Saturday
36	0	0	2	1	4	2	0	0	0	1	2	3	4	8	5	0	0	3	0	3	9	0	2	15	64	Feb 05 Sunday
37	6	5	4	5	0	6	1	2	9	4	19	18	12	7	9	12	3	5	3	1	0	4	4	9	148	Feb 06 Monday
38	2	1	0	2	2	4	2	1	4	11	18	25	11	10	11	5	0	1	0	3	1	2	1	2	119	Feb 07 Tuesday
39	3	2	3	0	2	2	6	1	9	3	9	14	15	12	7	3	4	3	8	7	9	5	1	6	134	Feb 08 Wednesday
40	3	5	2	2	1	1	0	2	6	16	13	17	22	22	10	3	1	3	7	1	2	3	1	1	144	Feb 09 Thursday
41	2	8	9	2	1	4	1	0	7	8	5	23	12	14	7	4	4	10	5	2	6	1	7	5	147	Feb 10 Friday
42	4	1	2	6	6	4	1	0	2	0	3	3	8	11	5	5	2	2	7	2	1	1	3	2	81	Feb 11 Saturday
43	1	11	4	2	3	0	5	3	2	3	4	3	8	3	1	1	1	2	1	1	3	4	5	2	73	Feb 12 Sunday
44	11	5	7	1	6	1	1	11	19	14	10	26	21	24	7	16	2	4	5	5	5	2	5	0	208	Feb 13 Monday
45	2	7	8	9	7	4	2	3	8	9	20	28	33	15	9	5	10	9	8	5	4	1	7	4	217	Feb 14 Tuesday
46	4	10	2	8	8	7	0	6	9	6	18	28	16	14	5	2	6	6	6	7	5	2	2	1	178	Feb 15 Wednesday
47	2	15	3	2	3	2	3	4	2	9	6	20	23	17	12	7	3	3	4	1	6	4	1	7	159	Feb 16 Thursday
48	3	3	8	6	3	14	4	2	12	13	5	25	13	17	1	5	2	6	3	1	10	6	5	6	173	Feb 17 Friday
49	2	6	4	9	2	3	9	1	10	2	7	3	7	8	0	2	1	2	1	0	4	3	0	3	89	Feb 18 Saturday
50	6	0	5	3	14	2	2	2	0	0	3	9	7	3	3	0	3	1	2	3	0	2	4	1	75	Feb 19 Sunday
51	2	2	4	5	5	0	1	5	12	7	11	13	7	13	5	10	9	5	8	3	7	5	3	1	143	Feb 20 Monday
52	1	0	4	6	4	4	1	2	11	2	21	34	15	9	16	14	6	3	4	4	0	4	6	1	172	Feb 21 Tuesday
53	0	8	3	6	4	3	2	1	13	12	7	20	22	14	11	4	7	0	6	5	2	10	4	4	168	Feb 22 Wednesday
54	4	2	7	4	6	15	2	1	9	9	12	19	11	8	4	11	5	8	9	1	4	18	10	6	185	Feb 23 Thursday
55	8	5	7	6	3	7	4	7	8	17	18	28	13	1	6	6	9	0	5	3	8	10	1	0	180	Feb 24 Friday
56	6	4	18	5	3	2	9	10	4	15	2	12	9	0	1	3	3	0	4	11	9	7	5	4	146	Feb 25 Saturday
57	0	0	1	5	4	1	1	3	25	0	11	17	3	2	3	9	0	2	1	0	10	0	2	2	102	Feb 26 Sunday
58	8	4	2	8	5	3	4	1	6	11	18	31	24	9	5	1	1	8	5	11	1	2	4	1	173	Feb 27 Monday
59	4	2	1	0	4	2	3	0	7	12	20	28	16	16	1	7	4	1	6	4	0	4	2	3	147	Feb 28 Tuesday
60	7	5	6	7	1	2	1	9	12	17	22	32	14	10	9	0	15	2	2	3	4	7	8	1	196	Mar 01 Wednesday
61	4	14	6	7	3	4	1	9	3	7	13	27	14	18	13	7	1	4	8	3	3	8	4	5	186	Mar 02 Thursday
62	5	2	3	3	2	1	0	9	6	16	14	10	22	11	10	0	0	0	1	3	6	7	6	0	137	Mar 03 Friday
63	3	17	1	3	4	6	5	5	4	1	14	28	12	3	6	2	1	1	8	2	7	4	3	3	143	Mar 04 Saturday
64	1	4	3	9	5	0	1	3	6	5	10	13	3	13	1	11	14	1	1	2	2	3	3	5	119	Mar 05 Sunday
65	2	4	1	3	0	0	4	6	7	11	8	12	17	17	10	6	5	4	5	1	3	3	4	5	138	Mar 06 Monday
66	4	1	2	8	9	2	0	6	3	12	21	19	5	3	16	4	5	5	2	7	2	3	4	3	146	Mar 07 Tuesday
67	8	5	7	8	7	5	1	3	2	13	20	27	13	8	14	3	7	1	11	13	13	14	3	3	209	Mar 08 Wednesday
68	4	5	1	5	4	2	1	9	7	17	7	29	25	10	12	13	1	4	6	6	7	1	1	4	181	Mar 09 Thursday
69	6	8	3	3	3	6	2	9	14	15	25	25	16	17	4	4	7	2	2	2	5	5	8	1	192	Mar 10 Friday
70	1	9	2	3	3	4	4	1	6	1	12	13	13	1	4	5	2	0	3	3	5	4	2	0	101	Mar 11 Saturday
71	1	1	0	2	1	2	0	5	1	1	8	3	12	1	3	4	1	0	3	5	1	2	3	2	62	Mar 12 Sunday
72	5	9	7	6	3	1	0	1	9	12	6	10	14	13	12	5	8	3	8	9	1	1	1	3	147	Mar 13 Monday
73	4	1	6	5	2	4	4	7	6	13	13	22	11	14	15	21	1	3	9	3	5	12	3	2	186	Mar 14 Tuesday
74	7	1	5	8	2	0	2	5	10	16	17	27	13	15	16	7	9	1	1	4	5	4	1	3	179	Mar 15 Wednesday
75	3	6	3	11	7	2	11	2	10	8	29	29	14	13	2	8	10	4	2	6	7	7	4	6	204	Mar 16 Thursday
76	11	0	15	3	3	1	2	3	12	12	19	22	19	11	3	1	1	6	2	2	4	3	2	4	161	Mar 17 Friday

Table 3.5.4 (Page 3 of 4)

GER .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
77	4	9	4	2	0	3	3	4	1	3	6	9	6	3	2	1	2	6	4	2	1	2	1	8	86	Mar 18 Saturday
78	0	2	4	2	2	3	8	5	0	1	7	9	2	2	3	3	6	4	4	4	0	2	6	4	83	Mar 19 Sunday
79	9	2	3	2	5	1	4	2	7	10	12	26	4	3	9	9	7	7	6	6	7	4	1	3	149	Mar 20 Monday
80	1	4	3	0	3	2	4	11	8	19	22	23	24	34	20	7	8	18	19	7	5	1	0	0	243	Mar 21 Tuesday
81	2	5	8	2	0	1	4	3	7	16	16	34	14	10	17	18	10	3	10	2	5	4	5	1	197	Mar 22 Wednesday
82	4	6	8	6	1	2	1	8	11	15	18	38	37	12	15	6	5	3	7	1	2	0	4	3	213	Mar 23 Thursday
83	4	2	4	6	5	2	1	10	15	29	22	22	9	12	6	4	9	9	2	3	5	2	1	1	185	Mar 24 Friday
84	1	3	5	2	3	6	0	3	0	2	11	0	6	8	5	5	2	2	1	0	2	0	0	10	77	Mar 25 Saturday
85	0	1	4	0	0	4	4	1	0	0	5	3	10	1	3	3	2	3	2	4	2	2	2	3	59	Mar 26 Sunday
86	0	1	2	9	3	4	2	7	12	7	9	20	7	7	1	6	1	3	0	1	2	1	0	0	105	Mar 27 Monday
87	4	2	10	3	5	0	5	3	11	10	31	5	13	17	13	8	3	0	3	5	6	1	8	2	168	Mar 28 Tuesday
88	5	4	4	2	1	1	1	2	8	17	17	20	9	7	7	1	12	0	2	1	2	1	0	2	126	Mar 29 Wednesday
89	7	1	2	4	1	3	5	6	11	9	22	11	14	12	18	10	1	8	8	3	3	4	8	3	174	Mar 30 Thursday
90	9	5	2	4	2	0	2	7	16	22	27	13	5	3	12	2	6	3	1	1	0	1	0	0	143	Mar 31 Friday
GER	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum	797	836	804	881	756	764	687	1030	1462	1889	2652	3167	2822	2114	1766	1425	1129	881	863	726	837	834	772	713	30607	Total sum
182	4	5	4	5	4	4	4	6	8	10	15	17	16	12	10	8	6	5	5	4	5	5	4	4	168	Total average
129	5	5	5	5	4	4	4	6	9	13	17	21	18	14	11	9	7	5	5	4	5	5	4	4	188	Average workdays
53	3	4	4	3	4	4	4	4	5	5	9	8	8	6	6	5	5	4	4	4	4	4	4	4	115	Average weekends

Table 3.5.4. (Page 4 of 4) Daily and hourly distribution of GERESS detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

APA .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Oct 01 Saturday
275	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Oct 02 Sunday
276	9	4	12	22	59	46	94	97	97	54	58	74	75	73	68	58	38	29	38	17	17	12	20	6	1077	Oct 03 Monday
277	11	2	18	48	65	75	88	91	73	79	91	54	76	104	78	85	78	43	42	35	14	17	14	17	1298	Oct 04 Tuesday
278	20	8	20	33	75	86	119	144	194	146	113	110	181	114	184	148	95	87	67	44	30	28	27	29	2102	Oct 05 Wednesday
279	7	14	41	43	82	62	122	136	99	92	83	94	123	92	104	83	35	63	60	19	16	12	1	9	1492	Oct 06 Thursday
280	10	10	29	55	52	114	110	187	127	111	88	83	69	94	66	70	71	41	20	21	8	9	0	5	1450	Oct 07 Friday
281	2	10	19	5	24	40	65	42	63	29	27	44	54	55	35	31	38	41	17	10	10	15	9	12	697	Oct 08 Saturday
282	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Oct 09 Sunday
283	3	5	9	34	59	89	103	104	111	75	96	66	91	96	94	72	34	38	41	29	27	19	7	0	1302	Oct 10 Monday
284	0	19	32	43	64	72	111	97	136	93	69	107	68	78	61	74	40	23	32	13	18	8	12	21	1291	Oct 11 Tuesday
285	8	3	14	56	49	75	112	99	106	94	112	91	70	85	99	64	22	27	33	21	14	7	5	0	1266	Oct 12 Wednesday
286	5	10	18	27	72	77	107	125	98	96	103	110	80	98	69	62	49	28	19	28	33	20	15	2	1351	Oct 13 Thursday
287	4	3	14	26	55	59	74	88	66	83	76	79	82	81	67	47	47	25	37	26	20	14	5	4	1082	Oct 14 Friday
288	8	15	17	11	26	19	15	36	10	13	21	32	32	29	8	27	13	11	23	19	6	2	14	6	413	Oct 15 Saturday
289	11	10	14	2	10	18	9	20	12	4	4	10	14	25	7	18	8	15	5	7	5	1	4	2	235	Oct 16 Sunday
290	1	6	8	9	13	19	37	27	8	25	20	22	13	47	48	29	15	19	20	33	31	19	9	10	488	Oct 17 Monday
291	7	16	22	27	35	57	58	58	33	38	61	52	38	40	45	32	32	48	24	13	16	5	8	7	772	Oct 18 Tuesday
292	8	8	8	24	34	30	41	30	51	34	40	56	53	24	28	17	27	33	16	8	16	6	3	7	602	Oct 19 Wednesday
293	4	13	14	32	38	39	65	54	44	60	37	28	51	38	18	18	23	13	9	12	19	6	3	4	642	Oct 20 Thursday
294	4	3	6	11	18	35	52	45	29	37	27	52	46	33	31	24	20	14	9	14	4	25	12	4	555	Oct 21 Friday
295	5	2	9	5	14	35	10	15	10	20	18	46	29	11	12	15	19	21	17	3	6	8	2	6	338	Oct 22 Saturday
296	15	11	8	20	14	18	19	27	47	42	25	31	19	31	39	26	21	30	17	10	0	18	9	10	507	Oct 23 Sunday
297	15	14	26	47	63	59	103	64	47	59	59	65	90	63	82	57	39	52	38	37	39	13	17	28	1176	Oct 24 Monday
298	20	27	30	48	51	58	95	98	72	83	75	88	85	115	57	72	61	51	31	13	11	32	7	6	1286	Oct 25 Tuesday
299	5	6	9	40	57	86	101	14	88	109	97	81	71	82	72	47	30	44	26	19	10	5	2	5	1106	Oct 26 Wednesday
300	7	19	17	47	51	97	98	120	105	93	90	101	93	49	67	64	45	38	26	20	14	3	23	8	1295	Oct 27 Thursday
301	7	12	26	31	60	73	75	97	113	62	85	89	81	75	75	45	12	48	52	18	32	42	27	20	1257	Oct 28 Friday
302	31	24	21	5	9	46	16	53	47	38	16	43	50	37	31	46	22	36	35	18	5	17	24	11	681	Oct 29 Saturday
303	25	9	11	11	11	16	19	25	27	18	40	29	39	27	29	33	16	29	12	10	23	8	14	4	485	Oct 30 Sunday
304	16	9	27	40	76	96	87	94	112	74	74	96	67	79	85	100	91	102	75	66	73	83	65	60	1747	Oct 31 Monday
305	80	70	86	89	88	85	105	87	78	96	83	65	80	66	56	40	24	21	29	20	19	26	10	15	1418	Nov 01 Tuesday
306	32	35	25	27	49	8	0	0	0	0	0	1	52	27	30	41	32	49	30	39	38	15	8	20	558	Nov 02 Wednesday
307	8	19	17	39	64	51	76	70	63	39	35	40	35	25	33	22	26	20	14	18	18	9	14	8	763	Nov 03 Thursday
308	20	21	25	28	40	42	46	43	42	45	38	32	59	28	24	34	24	36	25	32	39	28	22	20	793	Nov 04 Friday
309	12	20	26	19	12	25	18	19	17	20	17	16	17	18	15	9	6	9	8	9	2	0	5	17	336	Nov 05 Saturday
310	0	0	0	0	0	0	0	0	0	9	34	14	25	27	14	15	13	5	12	20	17	14	7	6	232	Nov 06 Sunday
311	11	9	14	9	17	12	16	18	9	10	26	36	20	26	10	14	27	25	10	29	21	20	13	24	426	Nov 07 Monday
312	27	8	16	13	51	46	57	67	37	30	22	31	13	32	28	30	44	51	31	50	50	30	24	26	814	Nov 08 Tuesday
313	34	23	28	18	40	77	77	57	20	27	52	42	56	74	52	55	40	27	32	25	33	52	69	22	1032	Nov 09 Wednesday
314	7	46	62	47	29	44	40	51	42	59	41	37	38	40	48	42	33	32	34	48	40	29	17	4	910	Nov 10 Thursday
315	18	10	14	49	55	32	43	39	49	30	44	18	51	24	9	17	29	19	30	13	16	20	18	14	661	Nov 11 Friday
316	17	14	14	29	43	24	45	57	40	41	30	37	39	23	56	66	54	45	38	41	85	48	32	47	965	Nov 12 Saturday
317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	61	26	42	27	6	17	207	Nov 13 Sunday
318	8	21	23	13	21	20	36	34	43	28	27	39	40	40	26	22	44	31	24	35	17	15	7	15	629	Nov 14 Monday
319	13	6	7	13	9	6	39	64	32	28	28	31	19	24	12	11	15	9	17	5	37	14	22	28	489	Nov 15 Tuesday
320	30	28	24	39	82	52	68	61	44	34	45	52	76	74	64	45	42	47	45	24	37	45	23	21	1102	Nov 16 Wednesday
321	34	19	27	59	32	45	44	42	42	29	23	47	27	65	29	39	35	32	47	40	43	41	24	26	891	Nov 17 Thursday
322	31	24	35	55	59	20	29	36	36	33	56	44	34	43	42	79	97	68	46	62	51	40	30	50	1100	Nov 18 Friday
323	54	34	18	20	37	25	30	43	69	65	74	72	60	51	32	34	27	28	22	17	22	18	13	16	881	Nov 19 Saturday
324	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Nov 20 Sunday
325	4	7	4	20	22	23	35	35	19	38	28	23	25	35	31	31	27	33	23	4	8	10	16	3	504	Nov 21 Monday
326	25	5	12	13	17	22	32	33	39	86	48	50	32	22	28	28	15	28	25	24	9	10	11	7	621	Nov 22 Tuesday
327	4	4	4	5	11	19	23	36	37	30	32	38	41	22	31	16	12	11	14	20	19	44	59	100	632	Nov 23 Wednesday
328	118	111	104	109	140	169	144	151	76	29	25	45	76	94	73	62	62	46	14	14	16	19	6	17	1720	Nov 24 Thursday
329	14	9	12	15	20	29	28	52	27	17	26	27	22	26	21	13	22	21	11	25	36	13	7	19	512	Nov 25 Friday

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APA .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
330	20	8	14	10	3	5	8	10	10	29	13	12	43	19	11	29	19	30	23	31	13	5	9	7	381	Nov 26 Saturday
331	1	7	6	8	10	6	13	20	13	28	52	70	59	68	60	15	11	11	20	14	18	3	26	4	543	Nov 27 Sunday
332	21	10	12	16	8	20	10	16	9	20	17	27	59	24	22	56	68	53	35	22	22	38	34	36	655	Nov 28 Monday
333	42	54	50	58	56	48	76	111	119	105	86	59	58	84	51	64	59	60	41	71	35	30	25	21	1463	Nov 29 Tuesday
334	56	15	14	45	66	60	78	69	57	85	90	75	104	104	131	108	91	60	67	84	85	94	113	86	1837	Nov 30 Wednesday
335	55	48	45	33	65	47	44	40	107	96	12	25	27	18	10	31	13	20	15	9	12	47	25	22	866	Dec 01 Thursday
336	16	17	15	19	22	32	22	18	34	22	13	30	41	24	11	26	24	19	30	18	22	18	16	21	530	Dec 02 Friday
337	13	21	11	3	44	45	41	17	42	30	56	26	12	3	2	8	5	8	2	7	3	4	11	1	415	Dec 03 Saturday
338	0	0	0	0	0	0	0	0	0	0	0	8	15	11	8	17	19	18	6	6	6	15	18	6	153	Dec 04 Sunday
339	23	7	3	23	11	19	28	23	37	19	39	37	23	18	32	38	40	44	15	21	19	34	24	13	590	Dec 05 Monday
340	8	18	27	25	36	18	34	22	29	15	23	43	40	36	52	53	41	53	39	50	65	43	42	34	846	Dec 06 Tuesday
341	14	29	39	56	28	19	43	51	45	36	33	35	41	36	47	39	32	29	18	29	7	18	22	11	757	Dec 07 Wednesday
342	19	20	24	70	71	66	68	75	91	75	42	47	38	47	22	25	14	22	37	27	28	26	21	28	1003	Dec 08 Thursday
343	26	43	30	52	61	49	45	47	45	47	30	43	44	52	63	85	42	60	15	42	58	29	10	13	1031	Dec 09 Friday
344	16	25	41	47	33	17	25	24	22	36	41	17	70	51	62	47	17	31	43	54	41	34	38	37	869	Dec 10 Saturday
345	32	12	31	53	14	35	71	65	26	73	87	85	70	92	67	64	41	19	36	28	38	24	44	40	1147	Dec 11 Sunday
346	25	33	35	44	5	25	38	49	58	52	42	23	24	37	23	20	9	10	12	17	23	11	3	1	619	Dec 12 Monday
347	0	5	15	16	20	9	18	43	25	24	32	28	39	30	18	11	7	11	32	9	6	9	16	41	464	Dec 13 Tuesday
348	18	16	13	22	45	59	73	60	60	87	94	95	103	41	36	35	44	33	14	13	20	22	7	14	1024	Dec 14 Wednesday
349	12	36	25	53	40	36	40	29	23	24	26	40	29	37	11	17	22	21	19	22	17	15	31	22	647	Dec 15 Thursday
350	24	31	37	23	24	8	51	7	0	0	0	0	0	0	0	0	0	0	0	0	8	29	18	18	278	Dec 16 Friday
351	24	14	33	36	27	16	23	29	41	37	35	32	32	43	13	29	18	40	21	12	26	17	26	11	635	Dec 17 Saturday
352	0	4	4	5	19	18	17	13	9	7	15	18	20	14	4	29	11	20	30	33	37	30	5	56	418	Dec 18 Sunday
353	22	32	13	20	21	28	13	26	22	30	18	44	33	21	31	34	34	23	41	29	60	35	35	47	712	Dec 19 Monday
354	41	84	41	51	49	53	59	96	54	49	61	47	44	57	45	26	18	22	18	20	29	31	30	21	1046	Dec 20 Tuesday
355	24	25	27	36	27	45	71	44	35	34	50	34	48	51	32	26	15	44	42	14	46	28	43	27	868	Dec 21 Wednesday
356	18	11	16	54	21	19	56	48	48	66	63	78	74	65	80	59	100	80	58	77	101	70	58	49	1369	Dec 22 Thursday
357	51	49	66	99	70	62	70	50	70	63	84	64	91	94	74	105	105	87	83	77	37	64	70	45	1730	Dec 23 Friday
358	47	49	43	65	62	65	41	60	64	79	74	91	88	87	61	83	96	107	86	90	91	84	62	97	1772	Dec 24 Saturday
359	60	76	92	108	82	86	84	84	73	59	68	75	65	86	79	91	86	98	64	58	50	43	65	57	1789	Dec 25 Sunday
360	43	20	36	46	42	67	45	43	30	48	27	50	45	46	37	26	42	46	36	30	17	27	17	9	875	Dec 26 Monday
361	14	20	10	45	36	38	39	32	37	17	21	28	15	27	30	27	14	43	18	25	15	18	15	15	599	Dec 27 Tuesday
362	21	23	16	34	38	24	42	39	20	47	25	24	54	22	21	11	14	29	28	21	25	55	28	35	696	Dec 28 Wednesday
363	43	21	17	21	35	18	87	41	26	49	48	22	35	39	35	52	77	17	25	19	16	44	42	25	854	Dec 29 Thursday
364	22	25	15	23	13	7	6	17	20	9	31	22	43	24	27	38	6	13	8	9	10	4	0	3	395	Dec 30 Friday
365	6	6	6	3	3	11	1	7	18	10	21	9	11	5	9	6	19	14	40	24	7	45	38	11	330	Dec 31 Saturday
1	15	30	12	11	6	1	4	10	10	2	11	10	19	12	4	8	19	10	11	15	16	15	10	7	268	Jan 01 Sunday
2	6	5	7	15	10	21	11	5	4	9	6	15	9	9	7	18	25	21	15	19	22	21	25	15	320	Jan 02 Monday
3	13	7	6	12	13	21	17	38	24	35	25	21	16	19	14	21	16	23	17	16	17	14	21	15	441	Jan 03 Tuesday
4	2	5	5	8	10	20	16	12	10	13	8	9	16	17	7	15	11	10	25	20	9	11	6	9	274	Jan 04 Wednesday
5	4	0	11	19	20	12	9	16	14	22	11	18	18	23	9	9	3	12	11	26	10	7	4	13	301	Jan 05 Thursday
6	7	3	10	20	12	6	5	14	27	17	26	15	32	15	3	16	14	10	5	21	14	4	14	12	322	Jan 06 Friday
7	5	6	8	1	2	8	4	8	6	4	6	5	7	7	4	6	5	5	1	5	4	3	0	1	111	Jan 07 Saturday
8	3	8	7	15	2	12	4	6	4	12	16	7	6	6	11	19	7	12	5	13	21	14	18	11	239	Jan 08 Sunday
9	6	6	1	12	9	13	7	11	3	1	1	13	5	19	16	9	15	8	13	24	16	20	25	9	262	Jan 09 Monday
10	12	17	14	31	29	8	13	28	17	15	11	15	10	14	36	34	15	26	21	10	3	1	13	19	412	Jan 10 Tuesday
11	10	30	27	48	33	46	55	44	66	60	33	42	42	47	38	25	15	21	14	10	6	1	15	2	730	Jan 11 Wednesday
12	3	12	8	19	44	36	43	39	49	36	18	16	29	18	11	37	13	14	16	14	7	8	4	10	504	Jan 12 Thursday
13	7	11	19	28	28	24	30	30	27	36	15	22	32	39	31	16	20	28	27	11	26	5	14	12	538	Jan 13 Friday
14	27	14	11	19	23	22	18	23	18	27	36	32	31	14	17	11	12	32	14	39	15	23	6	5	489	Jan 14 Saturday
15	7	1	7	1	3	3	1	8	7	4	4	2	1	2	3	8	4	5	3	4	2	5	9	20	114	Jan 15 Sunday
16	5	11	28	22	37	33	55	34	33	41	17	20	28	28	7	23	18	9	14	4	12	5	1	11	496	Jan 16 Monday
17	18	12	5	15	8	25	39	23	15	9	28	22	25	50	25	9	15	27	16	20	4	7	5	1	423	Jan 17 Tuesday
18	6	6	29	46	37	23	36	44	33	32	40	34	66	45	31	46	36	9	16	16	8	7	8	4	658	Jan 18 Wednesday
19	2	2	8	37	23	24	36	49	17	27	32	45	74	53	43	38	36	25	10	19	21	25	18	29	693	Jan 19 Thursday
20	6	11	30	29	28	34	56	47	31	63	59	36	59	26	21	17	25	21	35	36	36	34	35	42	817	Jan 20 Friday

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APA .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date	
21	21	19	26	17	27	22	27	26	13	32	30	32	39	29	22	21	21	16	14	14	25	24	15	19	551	Jan 21	Saturday
22	22	16	18	20	25	26	18	27	11	16	14	8	23	21	9	33	8	22	8	18	28	17	2	14	424	Jan 22	Sunday
23	29	9	7	11	17	33	70	41	59	44	28	39	52	68	44	57	66	56	44	51	44	42	30	23	964	Jan 23	Monday
24	26	51	47	46	29	33	21	14	23	39	34	34	33	20	21	22	25	13	17	3	19	18	22	10	620	Jan 24	Tuesday
25	19	12	9	9	18	20	24	24	29	28	50	41	28	24	11	31	65	23	21	30	25	26	2	2	571	Jan 25	Wednesday
26	18	10	27	16	29	47	39	66	46	33	33	42	23	25	14	50	26	16	6	36	34	31	37	39	743	Jan 26	Thursday
27	33	36	35	16	11	29	51	18	19	27	13	19	43	51	27	49	32	36	40	34	36	13	0	2	670	Jan 27	Friday
28	6	2	32	16	23	8	23	12	24	31	24	52	29	41	22	15	21	13	26	25	18	7	17	16	503	Jan 28	Saturday
29	4	14	32	25	20	20	15	32	20	33	19	19	31	12	12	16	17	8	16	15	18	15	37	16	466	Jan 29	Sunday
30	26	10	3	31	26	25	23	7	40	32	44	21	44	31	33	47	17	30	24	28	14	12	17	21	606	Jan 30	Monday
31	15	21	14	33	33	27	34	37	45	29	19	19	30	31	27	24	15	13	11	5	15	6	11	15	529	Jan 31	Tuesday
32	22	5	7	29	18	24	20	29	15	15	21	35	37	21	16	12	19	7	22	21	35	11	9	21	471	Feb 01	Wednesday
33	16	11	16	22	16	20	23	27	14	18	16	18	21	27	22	39	21	7	26	20	19	17	4	37	477	Feb 02	Thursday
34	11	9	6	19	43	44	36	53	33	10	27	25	26	21	14	18	15	10	18	16	22	22	10	8	516	Feb 03	Friday
35	14	13	19	23	26	13	6	10	15	4	13	29	13	48	24	20	13	17	32	12	13	5	22	15	419	Feb 04	Saturday
36	0	0	8	19	17	6	10	10	28	13	43	26	36	31	15	3	36	10	5	14	11	21	16	0	378	Feb 05	Sunday
37	0	0	0	21	31	42	71	37	35	14	20	33	27	15	24	22	31	10	8	9	11	13	30	15	519	Feb 06	Monday
38	3	7	30	24	12	15	11	6	5	5	12	11	23	29	46	55	28	23	14	22	32	14	11	14	452	Feb 07	Tuesday
39	7	12	20	25	30	52	40	41	46	38	27	30	68	40	40	17	32	33	25	23	21	15	17	12	711	Feb 08	Wednesday
40	18	20	28	41	30	42	53	49	21	35	24	27	29	23	21	31	11	13	24	23	6	9	34	23	635	Feb 09	Thursday
41	17	15	29	20	44	17	28	22	12	23	35	26	50	26	21	26	13	19	17	8	11	9	29	24	541	Feb 10	Friday
42	26	5	13	15	23	19	33	41	36	28	30	9	43	40	28	25	28	55	40	0	0	0	0	0	537	Feb 11	Saturday
43	2	7	7	18	1	20	35	64	40	47	14	25	24	7	8	15	10	18	16	24	34	57	41	20	554	Feb 12	Sunday
44	17	8	11	26	18	22	37	65	51	37	33	15	41	25	18	56	34	12	9	6	2	13	2	68	626	Feb 13	Monday
45	40	31	45	84	111	69	35	73	49	56	43	32	47	56	47	46	40	69	71	50	30	13	25	67	1229	Feb 14	Tuesday
46	65	47	24	25	18	18	29	25	14	11	53	23	39	20	12	12	10	9	28	12	1	4	17	15	531	Feb 15	Wednesday
47	23	29	14	10	6	8	28	20	11	20	16	10	25	23	8	40	32	30	14	11	11	5	9	5	408	Feb 16	Thursday
48	5	4	12	15	11	8	6	9	17	19	28	15	47	14	24	43	34	56	54	62	33	37	47	46	646	Feb 17	Friday
49	16	30	48	24	50	30	31	24	14	28	34	34	11	23	40	19	24	11	38	18	17	29	14	15	622	Feb 18	Saturday
50	24	16	29	33	35	14	37	33	30	15	21	17	32	20	30	29	9	8	5	8	8	8	15	13	489	Feb 19	Sunday
51	10	11	16	43	56	37	35	29	32	24	32	28	34	35	26	33	9	14	11	12	11	15	24	18	595	Feb 20	Monday
52	3	13	11	9	14	14	36	30	62	61	83	72	64	65	52	22	29	46	29	46	41	48	36	38	924	Feb 21	Tuesday
53	22	48	43	42	30	34	39	51	42	40	43	64	35	76	51	50	54	14	39	52	25	23	32	52	1001	Feb 22	Wednesday
54	49	36	16	20	16	31	20	15	14	14	40	28	21	27	29	16	27	24	45	22	15	46	32	15	618	Feb 23	Thursday
55	21	16	18	17	22	19	19	29	36	30	17	38	37	67	22	30	6	19	24	22	38	25	29	46	647	Feb 24	Friday
56	25	16	25	32	27	64	12	14	25	25	42	73	27	8	23	18	38	45	32	15	2	2	13	2	605	Feb 25	Saturday
57	0	2	7	3	4	13	11	11	6	14	22	5	11	21	14	27	7	27	20	18	65	25	1	5	339	Feb 26	Sunday
58	13	5	1	16	14	18	28	20	14	23	10	9	6	11	17	13	5	4	8	9	5	6	9	16	280	Feb 27	Monday
59	22	6	6	15	24	19	28	27	15	13	28	43	31	41	30	37	20	11	8	11	28	19	20	19	521	Feb 28	Tuesday
60	11	19	45	35	62	30	35	45	45	17	22	44	32	29	32	13	12	16	18	18	26	39	14	3	662	Mar 01	Wednesday
61	1	1	11	34	24	24	43	20	16	12	15	22	23	14	34	80	38	30	17	12	13	1	42	13	540	Mar 02	Thursday
62	17	5	13	13	26	28	25	38	32	58	62	72	63	46	48	52	19	8	15	7	6	16	13	19	701	Mar 03	Friday
63	3	16	6	8	8	20	26	26	30	20	19	30	12	15	30	10	4	8	12	14	13	10	18	6	364	Mar 04	Saturday
64	14	10	6	21	12	30	11	20	4	16	8	8	35	12	14	10	21	35	12	17	23	17	14	5	375	Mar 05	Sunday
65	23	10	17	13	19	36	33	28	40	24	13	24	29	13	34	22	15	15	12	10	14	37	13	8	502	Mar 06	Monday
66	7	9	4	8	15	22	36	16	13	17	30	34	33	34	22	13	26	23	46	21	27	10	5	29	500	Mar 07	Tuesday
67	4	7	11	23	9	6	8	18	44	28	25	12	25	17	11	6	9	5	1	10	7	2	31	14	333	Mar 08	Wednesday
68	1	2	8	8	9	12	4	22	16	10	5	12	21	19	8	23	20	28	33	19	38	13	13	20	364	Mar 09	Thursday
69	24	25	37	35	32	45	48	37	24	38	33	38	51	22	24	9	18	8	20	25	49	30	34	34	740	Mar 10	Friday
70	27	24	39	44	35	23	48	40	16	15	31	15	9	28	10	41	82	65	33	16	13	16	2	7	679	Mar 11	Saturday
71	0	8	2	7	10	11	17	73	62	32	44	60	25	5	6	11	10	13	3	21	21	33	44	37	555	Mar 12	Sunday
72	9	12	30	22	24	25	30	21	15	18	17	16	13	9	5	22	11	31	50	22	8	24	22	21	477	Mar 13	Monday
73	21	3	10	25	26	12	34	16	19	20	29	19	10	31	12	27	14	17	10	10	10	17	15	8	415	Mar 14	Tuesday
74	7	21	26	23	33	38	39	23	16	30	20	23	36	32	22	23	36	12	17	21	22	24	9	24	577	Mar 15	Wednesday
75	7	10	23	33	45	29	48	33	22	22	14	15	14	13	26	43	28	28	14	20	10	7	16	25	545	Mar 16	Thursday
76	18	13	33	85	58	69	62	76	70	45	33	39	71	41	33	35	45	29	32	19	13	21	46	46	1032	Mar 17	Friday

Table 3.5.5 (Page 3 of 4)

APA .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
77	30	8	16	15	34	7	25	39	43	41	28	18	10	11	6	3	4	4	12	3	2	0	4	5	368	Mar 18 Saturday
78	29	35	20	17	23	9	16	7	2	11	7	17	11	4	9	3	1	3	7	3	4	0	5	9	252	Mar 19 Sunday
79	6	6	3	7	8	5	15	15	26	12	11	6	15	22	8	7	10	4	7	12	2	4	5	7	223	Mar 20 Monday
80	7	2	4	16	16	12	25	15	7	13	6	14	11	14	12	21	6	8	6	3	1	8	12	9	248	Mar 21 Tuesday
81	7	13	10	11	16	16	18	8	13	9	13	16	11	22	16	6	16	16	7	24	19	4	15	0	306	Mar 22 Wednesday
82	9	6	7	16	25	18	24	19	8	15	24	10	12	17	10	7	11	19	8	3	8	13	19	16	324	Mar 23 Thursday
83	8	2	6	11	18	19	17	23	9	29	44	18	50	19	31	19	15	5	13	6	7	15	4	2	390	Mar 24 Friday
84	11	10	3	4	4	6	19	5	8	17	15	39	17	13	17	11	30	28	32	29	37	16	13	15	399	Mar 25 Saturday
85	0	0	0	0	0	0	0	0	0	0	0	0	14	22	22	19	14	26	25	20	56	44	12	13	287	Mar 26 Sunday
86	23	20	24	50	49	37	36	12	17	16	23	14	34	17	17	18	10	15	18	10	21	19	12	23	535	Mar 27 Monday
87	19	10	30	30	31	30	19	20	31	12	18	36	8	17	12	14	12	10	6	6	6	2	0	9	388	Mar 28 Tuesday
88	21	6	13	32	22	24	22	64	23	16	19	18	24	16	28	14	15	13	11	5	10	5	12	13	446	Mar 29 Wednesday
89	15	10	12	16	15	14	12	8	20	14	12	13	15	12	5	6	1	8	7	4	1	6	19	31	276	Mar 30 Thursday
90	33	46	35	47	9	18	26	28	7	21	24	23	27	15	15	20	11	2	10	18	14	26	35	4	514	Mar 31 Friday

APA 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Sum 2942 4904 5745 7085 6238 6400 6483 5799 4797 3934 3620 3361
3036 3538 5484 6942 6487 6225 6996 5631 4906 4317 3943 3419 122232 Total sum

APA	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
178	17	17	20	28	31	32	39	40	36	35	35	36	39	36	32	33	28	27	24	22	22	20	19	19	687	Total average
129	18	17	21	31	35	36	46	45	41	39	38	38	43	40	35	36	30	28	25	23	22	21	20	20	747	Average workdays
49	16	14	18	19	20	21	22	26	24	25	27	29	29	27	22	24	22	25	22	20	21	19	17	16	524	Average weekends

Table 3.5.5.(Page 4 of 4) Daily and hourly distribution of Apatity array detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

SPI .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date	
274	38	43	44	30	38	28	38	44	31	25	39	29	24	18	17	22	16	30	24	22	7	15	13	20	655	Oct 01	Saturday
275	6	17	19	23	18	8	12	9	22	13	17	21	13	9	10	12	21	10	24	13	20	34	10	17	378	Oct 02	Sunday
276	17	18	36	34	30	16	18	16	18	21	22	19	12	16	8	19	18	14	36	23	13	23	11	12	470	Oct 03	Monday
277	11	13	23	4	9	5	9	15	10	5	21	13	8	32	49	32	53	23	38	22	23	25	15	25	483	Oct 04	Tuesday
278	17	26	18	20	30	27	12	31	16	18	25	37	33	17	16	22	29	26	18	35	32	24	24	28	581	Oct 05	Wednesday
279	30	23	30	26	10	28	20	22	29	32	26	15	42	28	23	33	26	37	39	32	37	36	42	35	701	Oct 06	Thursday
280	37	27	36	41	47	34	31	42	55	46	72	35	32	43	27	46	35	40	37	39	52	65	47	51	1017	Oct 07	Friday
281	62	51	47	32	34	46	37	35	44	44	39	26	36	37	32	17	21	30	37	35	48	48	47	33	918	Oct 08	Saturday
282	26	32	31	28	18	21	17	13	46	21	17	20	20	21	25	19	25	16	38	57	25	38	28	20	622	Oct 09	Sunday
283	10	25	39	27	18	18	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	141	Oct 10	Monday
284	0	0	0	0	0	0	0	0	3	25	30	16	49	0	11	23	23	35	26	22	26	27	18	30	364	Oct 11	Tuesday
285	17	13	28	27	28	21	35	33	29	21	28	20	0	0	8	24	25	27	24	33	27	27	20	16	531	Oct 12	Wednesday
286	37	20	22	52	32	28	27	27	44	29	44	45	21	22	34	45	11	18	18	18	16	17	23	26	676	Oct 13	Thursday
287	28	20	31	14	15	32	16	16	22	28	29	15	10	30	25	30	19	9	22	12	20	20	29	11	503	Oct 14	Friday
288	25	14	12	15	15	21	24	21	21	13	17	20	19	12	13	22	15	20	8	13	6	25	17	24	412	Oct 15	Saturday
289	21	20	15	15	20	20	18	10	15	19	18	16	9	15	10	16	14	20	10	27	13	4	10	9	364	Oct 16	Sunday
290	13	9	16	18	5	12	3	16	9	16	7	20	7	11	14	22	11	17	15	17	17	11	9	14	309	Oct 17	Monday
291	14	8	13	37	24	22	25	35	16	19	8	5	37	25	31	33	0	0	0	0	76	8	23	78	537	Oct 18	Tuesday
292	72	86	83	104	146	91	116	72	93	125	35	125	159	89	65	77	55	74	44	49	61	42	54	28	1945	Oct 19	Wednesday
293	130	133	58	81	42	45	40	45	33	29	25	21	4	4	14	7	16	6	18	19	26	18	14	15	843	Oct 20	Thursday
294	26	37	55	111	121	110	159	195	192	184	124	110	128	97	104	59	42	33	65	55	62	60	49	61	2239	Oct 21	Friday
295	51	49	44	64	49	80	53	63	77	47	45	58	47	31	53	53	51	45	36	39	50	50	49	54	1238	Oct 22	Saturday
296	40	24	46	42	31	37	46	37	35	36	28	21	36	19	38	38	48	32	43	39	59	45	41	37	898	Oct 23	Sunday
297	36	46	31	49	30	41	43	23	33	32	40	44	47	47	39	67	91	95	79	70	96	97	114	106	1396	Oct 24	Monday
298	118	92	110	106	129	108	117	101	99	121	109	124	100	104	116	118	101	127	127	126	102	120	104	108	2687	Oct 25	Tuesday
299	116	116	107	110	115	132	121	108	101	89	92	96	81	88	90	85	71	59	80	66	51	59	80	72	2185	Oct 26	Wednesday
300	47	61	54	65	48	48	32	31	46	42	36	49	32	53	49	34	31	36	45	52	58	51	39	27	1066	Oct 27	Thursday
301	36	40	63	47	47	44	36	30	35	63	63	42	44	52	21	24	12	19	27	25	31	39	29	21	890	Oct 28	Friday
302	39	33	28	26	27	32	49	35	38	31	22	25	49	59	37	43	42	44	34	26	18	24	15	35	811	Oct 29	Saturday
303	59	36	26	41	47	40	55	32	29	58	26	34	33	33	41	74	78	102	116	83	48	0	0	0	1091	Oct 30	Sunday
304	0	0	0	0	0	0	0	124	161	145	193	191	138	176	185	180	162	28	24	19	17	24	25	15	1807	Oct 31	Monday
305	23	13	18	20	17	30	21	21	13	34	22	19	26	21	23	35	9	18	21	14	26	27	26	15	512	Nov 01	Tuesday
306	21	23	28	26	44	25	26	43	22	36	21	27	37	40	38	30	17	41	20	25	22	36	23	39	710	Nov 02	Wednesday
307	17	41	31	29	40	26	25	30	31	27	33	21	18	37	39	33	27	32	24	25	25	28	22	25	686	Nov 03	Thursday
308	25	31	26	28	42	31	38	29	28	29	41	22	37	30	35	32	37	37	29	44	41	17	28	48	785	Nov 04	Friday
309	29	30	46	40	46	42	28	40	45	41	16	33	42	48	28	42	40	45	26	33	18	24	26	17	825	Nov 05	Saturday
310	36	30	39	43	40	37	48	51	59	48	26	49	49	56	49	42	80	56	43	67	53	56	27	43	1127	Nov 06	Sunday
311	48	57	38	34	46	47	33	45	43	45	33	44	33	53	38	43	33	31	46	46	31	20	22	22	931	Nov 07	Monday
312	33	29	27	14	27	31	19	22	34	19	21	25	39	38	40	26	21	35	51	42	46	48	40	56	783	Nov 08	Tuesday
313	27	27	59	51	56	48	48	33	31	35	37	38	21	29	59	42	39	39	41	55	54	64	52	53	1038	Nov 09	Wednesday
314	43	41	49	40	13	45	38	28	35	27	31	29	29	19	25	13	34	18	17	27	20	21	30	28	700	Nov 10	Thursday
315	29	26	19	31	13	31	22	35	25	30	40	31	44	34	37	12	30	18	29	22	33	29	26	32	678	Nov 11	Friday
316	26	53	13	26	23	30	35	13	31	23	31	49	48	36	40	36	26	57	36	23	52	32	21	41	801	Nov 12	Saturday
317	24	25	43	39	23	21	34	35	26	39	35	33	33	35	19	24	21	34	13	23	41	44	37	33	734	Nov 13	Sunday
318	32	42	29	46	25	17	105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	296	Nov 14	Monday
319	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Nov 15	Tuesday
320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	18	14	28	14	18	103	Nov 16	Wednesday
321	32	15	15	27	24	40	25	29	25	31	33	33	25	41	69	38	25	31	18	28	28	26	35	41	734	Nov 17	Thursday
322	33	32	19	39	37	50	37	51	26	39	26	26	33	46	31	55	67	61	46	45	32	39	45	42	957	Nov 18	Friday
323	47	44	36	35	31	38	56	40	48	30	50	43	41	57	45	48	58	47	45	44	60	72	61	69	1145	Nov 19	Saturday
324	57	53	47	54	61	64	66	54	48	28	73	37	46	54	72	38	38	63	49	48	52	35	48	15	1200	Nov 20	Sunday
325	18	27	21	15	18	16	30	19	25	15	15	24	17	18	16	11	47	24	22	32	35	28	32	18	543	Nov 21	Monday
326	20	26	20	12	12	17	24	11	19	31	24	19	25	26	28	24	16	23	37	36	33	25	22	48	578	Nov 22	Tuesday
327	22	14	20	20	16	44	37	21	17	26	26	25	24	16	38	34	26	19	13	36	26	49	24	25	618	Nov 23	Wednesday
328	23	26	23	20	17	20	28	19	39	27	29	19	35	22	26	37	26	21	24	37	22	32	27	27	626	Nov 24	Thursday
329	14	31	14	24	22	28	17	19	20	25	22	11	16	27	13	30	21	20	27	27	20	51	23	23	545	Nov 25	Friday

Table 3.5.6 (Page 1 of 4)

SPI .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
330	30	33	22	35	20	21	39	25	21	31	25	32	31	32	32	28	45	48	26	15	31	22	33	23	700	Nov 26 Saturday
331	31	21	25	18	21	17	9	9	8	19	18	24	20	42	18	21	10	38	18	15	18	53	11	20	504	Nov 27 Sunday
332	25	22	41	31	13	21	13	29	17	32	25	23	39	25	28	40	17	30	31	31	23	21	18	13	608	Nov 28 Monday
333	35	37	28	36	35	21	19	38	26	19	36	26	42	33	32	31	27	48	17	22	32	25	32	17	714	Nov 29 Tuesday
334	21	30	32	30	11	19	19	22	13	23	38	25	43	38	47	36	18	19	8	13	8	14	15	8	550	Nov 30 Wednesday
335	24	13	18	9	15	9	13	14	11	17	21	8	19	19	10	14	9	7	16	7	9	13	7	12	314	Dec 01 Thursday
336	7	10	21	27	51	37	53	29	53	73	68	26	27	36	39	52	43	31	55	45	67	43	37	32	962	Dec 02 Friday
337	25	27	19	18	12	29	19	3	16	7	8	11	11	4	20	16	6	21	22	13	12	9	6	2	336	Dec 03 Saturday
338	6	5	4	3	1	9	11	8	21	16	45	29	11	24	8	37	31	25	29	23	29	20	24	19	438	Dec 04 Sunday
339	25	35	35	24	30	31	42	43	25	40	21	51	7	31	10	13	5	8	31	11	10	15	4	3	550	Dec 05 Monday
340	6	12	15	11	7	8	15	17	12	12	30	16	15	4	3	12	14	32	34	20	13	7	36	18	369	Dec 06 Tuesday
341	17	16	21	14	8	21	21	16	13	17	23	24	37	35	29	32	28	17	26	9	24	22	25	17	512	Dec 07 Wednesday
342	21	29	22	28	21	27	17	33	30	26	24	26	18	25	19	11	12	3	8	16	19	32	15	14	496	Dec 08 Thursday
343	8	5	0	8	2	10	13	19	13	32	14	12	14	10	14	16	7	9	33	34	31	17	26	34	381	Dec 09 Friday
344	18	33	33	26	26	18	26	30	19	17	27	39	48	45	13	28	19	28	28	40	28	24	21	22	656	Dec 10 Saturday
345	16	52	94	24	23	37	20	30	40	22	21	31	41	32	26	47	21	73	30	64	30	34	36	17	861	Dec 11 Sunday
346	34	55	14	37	45	38	21	14	10	63	68	51	42	52	54	56	41	38	39	90	67	38	44	54	1065	Dec 12 Monday
347	54	33	10	19	18	8	20	23	22	19	20	30	19	28	14	13	12	21	36	52	54	101	29	30	685	Dec 13 Tuesday
348	27	15	36	29	21	28	38	22	27	33	37	18	14	31	23	22	49	34	47	28	19	38	29	23	688	Dec 14 Wednesday
349	36	37	32	22	18	34	16	22	9	22	11	25	24	15	12	18	5	9	3	7	31	16	15	8	447	Dec 15 Thursday
350	7	10	12	15	11	16	13	17	14	7	53	51	20	19	21	18	12	2	15	12	10	18	20	11	404	Dec 16 Friday
351	15	12	19	28	12	10	35	21	8	13	6	6	13	17	19	14	19	19	13	19	27	23	8	11	387	Dec 17 Saturday
352	13	10	22	12	18	37	18	18	15	15	26	40	38	30	20	30	41	33	54	20	27	20	13	24	594	Dec 18 Sunday
353	34	17	42	37	23	15	18	11	9	13	3	5	8	7	2	10	3	13	13	19	12	10	21	5	350	Dec 19 Monday
354	19	13	7	13	24	36	19	16	32	23	19	63	13	10	14	19	21	15	20	10	20	11	15	19	471	Dec 20 Tuesday
355	9	6	12	6	15	25	18	9	15	11	17	21	12	8	19	26	22	38	17	32	19	24	29	19	429	Dec 21 Wednesday
356	26	26	26	26	29	25	29	32	40	42	42	27	26	25	15	30	26	34	24	32	21	8	23	7	641	Dec 22 Thursday
357	9	11	19	12	16	17	32	20	8	10	14	11	15	11	7	11	14	24	31	11	10	18	15	13	359	Dec 23 Friday
358	18	15	16	10	5	19	3	8	13	10	17	6	12	23	9	24	17	11	11	20	27	15	24	19	352	Dec 24 Saturday
359	30	29	32	26	21	15	13	28	19	52	28	23	35	36	21	15	19	42	44	54	47	47	58	34	768	Dec 25 Sunday
360	34	81	15	42	31	33	54	37	30	27	51	46	20	38	55	37	52	34	46	54	57	53	53	60	1040	Dec 26 Monday
361	58	48	53	30	41	46	22	34	54	42	40	106	60	100	63	44	66	114	53	48	55	53	52	37	1319	Dec 27 Tuesday
362	37	46	67	100	34	26	31	19	56	62	52	36	138	57	71	55	83	66	55	54	81	118	95	56	1495	Dec 28 Wednesday
363	55	61	74	80	75	82	64	71	80	95	80	70	71	70	86	113	114	110	110	101	34	33	53	32	1814	Dec 29 Thursday
364	25	21	28	44	38	34	21	20	25	26	36	28	24	40	34	42	45	53	57	52	35	36	49	42	855	Dec 30 Friday
365	54	44	70	54	72	59	62	64	55	48	46	51	51	29	61	53	54	30	35	45	46	34	42	45	1204	Dec 31 Saturday
1	31	45	59	47	75	52	41	80	77	86	108	110	125	112	130	146	118	106	113	125	121	125	123	134	2289	Jan 01 Sunday
2	131	102	133	136	144	107	119	115	131	109	154	94	111	141	132	119	109	123	123	104	116	139	117	123	2932	Jan 02 Monday
3	125	113	116	128	115	88	101	109	90	92	82	97	88	96	78	77	81	79	72	88	77	102	97	88	2279	Jan 03 Tuesday
4	103	99	104	104	71	105	101	43	73	80	85	70	74	72	79	83	52	81	56	66	49	50	56	46	1802	Jan 04 Wednesday
5	40	42	30	33	57	31	31	30	35	18	26	31	37	32	20	32	26	38	38	29	29	47	35	23	790	Jan 05 Thursday
6	32	12	24	39	27	28	31	24	42	36	22	45	58	50	43	16	28	29	26	40	12	13	21	28	726	Jan 06 Friday
7	26	12	25	8	19	27	41	30	16	18	24	21	43	36	16	17	24	31	17	22	15	18	13	5	524	Jan 07 Saturday
8	9	6	6	17	19	22	10	15	15	19	14	14	13	10	22	25	21	18	4	20	14	16	3	2	334	Jan 08 Sunday
9	8	15	26	27	35	26	27	31	35	16	21	17	21	24	27	26	15	25	27	20	14	21	55	26	585	Jan 09 Monday
10	23	19	23	34	22	27	31	24	49	45	34	43	30	32	21	26	23	31	30	43	14	34	12	17	687	Jan 10 Tuesday
11	28	19	44	58	99	66	33	30	30	21	43	28	55	56	37	22	19	36	34	33	22	34	14	14	875	Jan 11 Wednesday
12	27	43	38	38	51	31	30	28	20	28	41	27	28	26	28	45	39	36	27	22	29	27	23	34	766	Jan 12 Thursday
13	26	34	31	33	25	27	32	32	22	18	45	36	29	20	29	22	10	4	17	15	1	4	1	2	515	Jan 13 Friday
14	14	9	15	14	22	22	44	45	38	53	41	14	19	24	17	8	35	37	22	20	17	21	4	8	563	Jan 14 Saturday
15	11	9	15	20	19	17	15	11	15	6	11	62	20	60	28	31	28	19	30	15	25	20	19	14	520	Jan 15 Sunday
16	14	9	12	16	3	37	33	12	61	24	26	21	31	16	61	29	26	29	50	40	28	55	31	33	697	Jan 16 Monday
17	18	23	36	31	36	34	66	34	71	37	16	32	49	37	24	38	28	37	41	19	20	46	31	27	831	Jan 17 Tuesday
18	58	56	57	30	35	28	38	53	68	32	19	9	17	20	42	23	24	21	53	73	37	50	45	47	935	Jan 18 Wednesday
19	64	62	37	36	18	16	30	22	25	65	40	24	21	29	25	31	51	76	66	33	23	51	19	22	886	Jan 19 Thursday
20	13	4	24	21	13	19	25	28	29	37	21	8	40	9	23	29	16	17	25	23	26	34	20	32	536	Jan 20 Friday

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SPI .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
21	20	19	15	17	12	8	16	39	25	27	20	17	26	28	24	16	20	30	17	23	16	26	18	19	498	Jan 21 Saturday
22	25	33	15	17	12	29	15	19	10	11	30	27	36	52	62	39	33	20	16	24	20	35	23	40	643	Jan 22 Sunday
23	27	25	27	18	25	31	82	36	33	27	21	39	38	54	45	42	75	64	47	75	56	48	75	67	1077	Jan 23 Monday
24	43	38	38	17	16	15	12	22	20	13	16	29	36	38	34	38	7	26	31	28	40	46	39	50	692	Jan 24 Tuesday
25	55	51	66	49	61	55	71	62	33	60	40	32	25	43	44	52	56	40	46	55	62	64	54	48	1224	Jan 25 Wednesday
26	52	54	57	46	57	41	51	64	48	61	49	58	74	67	54	67	55	96	99	90	95	77	99	119	1630	Jan 26 Thursday
27	101	91	88	99	93	103	104	110	121	130	111	113	119	115	130	130	153	151	133	141	138	133	134	148	2889	Jan 27 Friday
28	125	150	137	140	153	149	140	118	117	124	134	127	143	141	133	158	103	115	122	135	139	105	119	127	3154	Jan 28 Saturday
29	128	141	113	114	138	114	129	148	157	128	156	140	166	134	121	134	109	121	97	108	107	122	93	111	3029	Jan 29 Sunday
30	97	112	67	103	95	96	93	93	79	84	103	86	93	73	82	74	74	89	101	69	76	86	96	70	2091	Jan 30 Monday
31	85	96	80	77	61	65	49	33	56	50	42	46	33	33	49	51	41	155	40	53	30	76	32	22	1355	Jan 31 Tuesday
32	28	25	35	29	21	43	49	44	26	35	25	23	16	29	17	28	36	30	20	23	22	22	22	15	663	Feb 01 Wednesday
33	26	35	12	16	26	32	83	53	22	50	69	27	39	40	67	27	42	24	30	36	38	35	23	18	870	Feb 02 Thursday
34	30	16	29	16	40	42	18	10	21	9	17	25	13	26	29	40	21	33	34	25	29	22	25	16	586	Feb 03 Friday
35	23	19	31	17	25	22	37	39	29	45	48	48	61	57	37	54	29	21	38	16	25	18	28	31	798	Feb 04 Saturday
36	29	43	47	31	40	19	15	26	24	75	95	34	37	30	22	29	22	25	47	27	56	30	46	67	916	Feb 05 Sunday
37	54	43	35	35	48	71	34	54	57	37	71	70	41	46	61	71	35	52	48	49	43	56	49	41	1201	Feb 06 Monday
38	47	57	52	58	39	42	47	47	31	19	44	49	30	47	44	41	43	44	39	32	40	45	18	24	979	Feb 07 Tuesday
39	14	43	29	37	55	27	43	42	35	33	50	46	52	24	37	30	45	39	57	29	40	29	31	21	888	Feb 08 Wednesday
40	22	41	40	23	28	50	28	26	18	17	25	51	26	20	19	37	84	20	25	14	27	35	40	17	733	Feb 09 Thursday
41	20	4	31	13	26	13	21	51	58	32	23	8	35	25	25	19	21	18	19	18	21	17	28	20	566	Feb 10 Friday
42	30	29	22	22	22	24	33	29	38	143	33	44	37	46	19	40	28	11	26	43	35	38	35	47	874	Feb 11 Saturday
43	28	47	24	41	33	39	35	27	22	43	56	47	31	36	45	32	43	56	33	37	45	45	60	48	953	Feb 12 Sunday
44	72	48	68	60	49	63	81	80	73	50	49	77	82	53	30	59	46	22	42	32	26	31	13	15	1221	Feb 13 Monday
45	19	23	39	19	32	43	19	26	34	15	28	41	27	21	28	32	41	24	31	41	29	13	23	24	672	Feb 14 Tuesday
46	28	33	19	18	47	30	38	32	30	83	35	27	36	51	21	29	28	37	47	37	42	30	26	34	838	Feb 15 Wednesday
47	48	53	85	47	31	25	50	51	38	43	29	45	56	26	30	29	8	27	31	41	52	55	9	57	966	Feb 16 Thursday
48	47	38	54	37	26	41	23	33	21	16	44	42	26	23	28	21	22	21	23	23	27	26	28	23	713	Feb 17 Friday
49	17	17	18	18	10	21	20	19	15	14	26	31	31	38	31	15	22	23	17	19	31	34	24	31	542	Feb 18 Saturday
50	17	18	29	21	29	8	28	37	32	11	22	39	30	32	35	20	47	21	23	14	34	33	24	9	613	Feb 19 Sunday
51	15	24	31	32	31	23	13	29	17	31	35	37	34	23	28	35	18	68	58	12	27	33	38	22	714	Feb 20 Monday
52	8	39	35	11	20	11	9	40	39	42	15	15	10	35	6	10	19	15	17	20	31	28	19	9	503	Feb 21 Tuesday
53	23	17	22	5	17	23	20	24	57	35	39	43	40	38	17	10	18	38	25	27	31	22	18	15	624	Feb 22 Wednesday
54	16	8	9	6	11	38	17	33	54	18	32	30	42	33	18	30	33	50	37	37	24	47	25	24	672	Feb 23 Thursday
55	27	24	20	11	12	21	19	14	14	28	17	21	25	26	29	17	30	39	16	16	31	30	25	30	542	Feb 24 Friday
56	22	19	16	17	19	17	14	16	19	35	53	23	13	38	32	17	17	18	18	20	22	47	31	34	577	Feb 25 Saturday
57	20	12	25	10	26	36	16	16	15	21	37	18	69	18	31	58	23	11	28	22	36	7	14	21	590	Feb 26 Sunday
58	21	31	19	18	36	25	20	19	26	19	15	26	24	17	13	32	32	34	13	25	47	38	20	24	594	Feb 27 Monday
59	20	8	17	11	16	27	14	9	13	14	32	15	9	23	15	18	19	21	35	13	26	30	47	13	465	Feb 28 Tuesday
60	22	28	36	27	34	15	20	25	35	21	19	23	25	44	8	24	24	15	10	15	18	18	14	16	536	Mar 01 Wednesday
61	13	10	13	3	3	11	19	26	19	20	5	4	10	15	7	12	25	14	6	17	17	10	11	11	301	Mar 02 Thursday
62	9	10	6	7	15	11	12	18	14	45	6	29	30	38	38	16	28	11	18	24	29	7	36	13	470	Mar 03 Friday
63	24	18	9	8	8	21	17	12	18	18	15	72	50-	43	19	42	48	33	19	26	34	18	11	12	595	Mar 04 Saturday
64	28	30	10	10	11	6	15	2	15	23	13	44	19	12	10	30	24	6	21	12	41	11	13	64	470	Mar 05 Sunday
65	43	15	24	10	19	6	25	32	18	38	40	26	25	30	25	44	27	33	41	45	39	22	28	31	686	Mar 06 Monday
66	11	12	16	19	30	45	60	49	41	43	21	51	46	20	41	40	88	53	42	43	57	37	46	29	940	Mar 07 Tuesday
67	32	29	17	14	26	26	31	29	18	55	34	28	32	28	40	27	26	32	27	28	34	37	35	24	709	Mar 08 Wednesday
68	14	16	20	20	24	22	20	36	41	28	35	17	35	19	11	24	41	35	22	32	40	38	29	27	646	Mar 09 Thursday
69	30	23	18	14	32	19	19	22	32	42	33	52	24	33	39	50	54	28	48	31	35	46	13	32	769	Mar 10 Friday
70	46	19	18	31	37	23	25	33	32	40	25	45	28	21	28	62	31	18	25	16	24	9	28	18	682	Mar 11 Saturday
71	29	23	8	8	14	11	4	7	9	16	28	9	27	14	13	12	4	11	15	16	5	6	7	9	305	Mar 12 Sunday
72	8	18	3	3	5	5	10	11	15	7	7	11	20	7	12	15	4	17	5	4	9	22	5	6	229	Mar 13 Monday
73	9	11	6	14	15	9	9	10	8	9	14	13	7	20	14	12	48	21	26	27	6	11	16	6	341	Mar 14 Tuesday
74	7	16	16	24	12	15	17	20	25	25	22	48	45	36	40	21	28	32	38	23	27	20	22	27	606	Mar 15 Wednesday
75	32	25	34	27	23	34	36	31	56	67	54	44	25	41	33	57	57	53	49	97	63	70	61	64	1133	Mar 16 Thursday
76	46	45	68	44	62	38	20	44	30	59	96	54	49	78	46	63	43	42	55	40	54	43	62	31	1212	Mar 17 Friday

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SPI .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
77	44	36	42	35	46	55	39	38	52	96	116	56	70	76	112	98	54	71	95	105	69	68	60	68	1601	Mar 18 Saturday
78	62	58	43	62	66	43	49	59	47	85	111	79	66	63	49	49	70	91	77	54	53	27	41	27	1431	Mar 19 Sunday
79	34	29	53	56	57	40	40	50	37	40	49	67	61	64	39	67	34	59	65	69	49	43	54	41	1197	Mar 20 Monday
80	48	44	44	35	64	57	49	26	45	53	55	61	47	44	53	48	40	46	32	56	31	53	35	48	1114	Mar 21 Tuesday
81	57	48	26	32	54	32	30	39	49	22	35	30	35	29	39	24	23	17	24	17	38	12	9	18	739	Mar 22 Wednesday
82	28	17	18	7	9	16	15	28	30	25	26	30	30	24	37	58	68	60	44	34	39	28	21	17	709	Mar 23 Thursday
83	66	54	57	41	50	49	33	55	39	40	46	32	42	61	32	28	24	52	75	25	61	36	11	14	1023	Mar 24 Friday
84	15	23	52	27	29	50	31	33	36	40	48	29	21	64	37	16	21	64	44	32	28	32	22	40	834	Mar 25 Saturday
85	38	22	46	20	37	32	34	28	33	109	144	40	65	63	32	46	55	47	57	28	23	36	21	22	1078	Mar 26 Sunday
86	39	29	33	37	29	39	46	44	49	74	57	31	59	44	41	61	66	42	36	56	43	51	55	55	1116	Mar 27 Monday
87	38	39	34	41	75	85	56	69	114	77	73	66	69	78	81	75	81	67	82	74	63	77	75	92	1681	Mar 28 Tuesday
88	78	72	70	75	91	46	67	93	75	67	67	66	55	52	82	53	49	82	60	50	77	63	52	75	1617	Mar 29 Wednesday
89	70	56	80	57	44	64	97	94	82	89	102	87	79	85	76	63	58	77	4	0	0	0	31	79	1546	Mar 30 Thursday
90	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	Mar 31 Friday
SPI	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum	6153	6087	6272	6068	6274	6260	6418	6409	6640	7094	7182	6885	6971	6935	6621	6901	6569	6897	6658	6540	6537	6584	5968	6057	156980	Total sum
181	34	34	35	34	35	35	35	35	37	39	40	38	39	38	37	38	36	38	37	36	36	36	33	33	867	Total average
128	34	34	35	35	35	35	36	36	38	39	38	38	38	37	36	37	36	37	37	36	35	37	34	33	866	Average workdays
53	33	33	33	31	32	33	34	33	34	39	42	39	40	40	37	39	37	39	37	37	37	35	31	33	858	Average weekends

Table 3.5.6. (Page 4 of 4) Daily and hourly distribution of Spitsbergen array detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

HFS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Oct 01 Saturday
275	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Oct 02 Sunday
276	0	0	0	0	0	0	0	3	5	5	5	1	2	0	0	0	0	0	0	0	0	0	0	0	21	Oct 03 Monday
277	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	89	78	0	0	0	0	0	0	0	201	Oct 04 Tuesday
278	0	0	0	0	0	0	0	0	0	0	27	33	31	25	33	27	44	28	20	15	25	14	18	12	352	Oct 05 Wednesday
279	13	15	7	9	22	16	32	45	14	27	20	14	40	13	15	38	17	13	11	6	7	13	5	9	421	Oct 06 Thursday
280	10	4	8	12	9	7	2	12	11	2	14	22	11	16	11	23	5	14	15	4	6	9	8	6	241	Oct 07 Friday
281	4	6	4	11	11	14	10	11	18	5	21	15	19	13	5	9	16	10	15	13	16	12	0	0	258	Oct 08 Saturday
282	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Oct 09 Sunday
283	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	Oct 10 Monday
284	0	0	0	0	0	0	0	0	0	0	26	23	33	31	11	12	1	3	8	1	7	1	6	5	168	Oct 11 Tuesday
285	4	7	6	6	7	5	31	19	21	27	21	9	15	13	18	6	11	7	5	0	2	5	5	7	257	Oct 12 Wednesday
286	4	1	6	8	10	3	5	2	5	4	5	12	10	21	16	5	9	15	6	4	5	11	6	5	178	Oct 13 Thursday
287	7	2	3	4	6	0	0	0	0	9	3	6	5	6	14	11	19	5	4	4	6	6	4	7	131	Oct 14 Friday
288	3	6	6	3	6	12	7	2	10	8	11	6	7	14	4	14	10	5	5	8	20	9	14	0	190	Oct 15 Saturday
289	0	0	0	0	0	0	0	0	0	8	6	8	4	12	11	5	8	11	11	2	2	3	6	1	98	Oct 16 Sunday
290	0	4	3	4	9	9	8	10	2	5	6	13	16	14	14	14	7	4	4	4	7	3	11	2	173	Oct 17 Monday
291	4	6	4	3	4	8	22	18	17	24	16	22	15	12	17	8	11	16	15	5	8	3	6	7	271	Oct 18 Tuesday
292	8	4	6	8	3	7	3	8	5	2	3	12	14	31	24	30	7	5	15	4	4	5	9	3	220	Oct 19 Wednesday
293	5	9	4	6	10	6	3	2	19	25	8	10	21	21	8	12	5	6	10	8	3	1	3	4	209	Oct 20 Thursday
294	6	6	5	3	4	16	4	4	22	40	11	14	12	27	46	9	5	9	8	5	5	6	4	0	271	Oct 21 Friday
295	7	9	5	8	9	2	7	4	14	14	4	4	15	15	10	18	5	4	10	6	12	7	11	14	214	Oct 22 Saturday
296	13	5	4	14	8	3	5	5	12	11	6	15	8	7	9	5	9	6	10	11	10	11	5	9	201	Oct 23 Sunday
297	12	7	7	3	14	2	19	15	7	10	29	14	10	8	16	22	6	19	2	7	3	1	3	4	240	Oct 24 Monday
298	3	9	3	9	7	4	14	9	7	51	53	29	6	20	0	6	12	18	8	8	1	2	5	3	287	Oct 25 Tuesday
299	3	2	10	18	83	13	9	7	8	1	3	3	24	20	28	17	5	8	12	9	3	6	0	7	299	Oct 26 Wednesday
300	3	6	5	6	4	6	8	6	8	5	6	14	18	15	31	31	22	12	7	2	8	2	12	12	249	Oct 27 Thursday
301	4	8	3	9	6	5	17	13	9	10	11	22	13	20	27	15	8	10	11	11	11	7	6	11	267	Oct 28 Friday
302	13	0	4	2	7	4	13	9	8	9	6	19	15	21	27	9	19	8	5	8	7	4	10	12	239	Oct 29 Saturday
303	20	14	19	24	13	12	30	14	27	31	18	25	22	12	6	5	9	6	12	16	14	3	12	6	370	Oct 30 Sunday
304	5	1	4	11	5	0	4	11	6	12	9	11	18	15	23	12	9	13	1	6	12	8	12	7	215	Oct 31 Monday
305	6	5	3	4	0	4	11	4	12	2	16	15	23	16	11	18	6	13	4	1	9	0	5	5	193	Nov 01 Tuesday
306	3	9	7	4	1	8	5	4	4	9	17	14	27	35	42	22	21	7	16	8	7	1	3	10	284	Nov 02 Wednesday
307	9	9	4	10	6	1	7	8	7	9	20	19	27	17	23	12	6	16	8	1	3	6	1	2	231	Nov 03 Thursday
308	7	9	6	3	6	10	13	12	12	10	25	17	22	13	13	1	7	3	9	2	2	5	3	4	214	Nov 04 Friday
309	5	6	10	6	4	17	12	6	6	15	16	17	18	14	14	26	5	6	12	6	13	4	16	9	263	Nov 05 Saturday
310	20	14	7	26	19	26	19	7	15	11	22	18	21	20	10	11	11	5	1	2	7	5	2	3	302	Nov 06 Sunday
311	5	7	2	6	5	2	9	6	2	1	3	15	10	18	19	25	7	2	2	4	1	18	6	0	175	Nov 07 Monday
312	4	3	2	4	5	7	2	8	10	20	12	21	7	6	19	17	11	17	10	8	7	4	5	9	218	Nov 08 Tuesday
313	5	5	1	7	8	7	5	5	5	3	6	4	17	6	24	14	1	4	8	4	7	13	3	4	166	Nov 09 Wednesday
314	4	3	3	11	5	2	6	4	3	5	6	21	14	18	18	9	2	9	3	2	4	4	5	1	162	Nov 10 Thursday
315	1	4	10	6	3	6	5	8	7	8	15	21	13	7	15	9	4	1	0	0	0	0	3	0	146	Nov 11 Friday
316	0	0	0	0	0	0	0	0	0	0	11	13	10	7	9	13	2	12	4	4	0	7	3	2	97	Nov 12 Saturday
317	9	0	4	7	13	0	2	18	24	11	18	5	12	14	8	3	4	2	4	3	15	5	3	1	185	Nov 13 Sunday
318	4	1	3	2	7	2	0	3	1	5	10	15	8	9	14	4	6	6	2	16	3	7	10	2	140	Nov 14 Monday
319	8	3	6	0	4	4	5	3	6	15	8	9	8	11	27	9	5	3	5	5	20	5	2	4	175	Nov 15 Tuesday
320	10	1	6	3	2	4	2	6	5	7	13	15	9	19	11	5	1	11	9	7	3	4	0	6	159	Nov 16 Wednesday
321	5	11	2	3	3	4	1	1	6	2	5	8	28	22	30	10	4	2	1	2	3	7	5	5	170	Nov 17 Thursday
322	2	3	5	8	3	7	5	2	5	14	17	9	25	20	19	12	8	8	4	8	10	7	8	15	224	Nov 18 Friday
323	10	14	33	15	15	23	21	10	11	24	13	10	10	13	6	4	4	8	18	7	5	17	5	7	303	Nov 19 Saturday
324	5	6	4	11	7	7	10	10	7	20	15	11	15	11	16	13	8	9	14	7	15	4	2	6	233	Nov 20 Sunday
325	6	5	11	11	10	4	7	6	15	9	12	4	10	18	12	13	14	13	0	6	3	24	1	2	216	Nov 21 Monday
326	19	12	4	4	4	10	8	1	0	12	5	16	12	19	11	10	10	1	2	6	4	2	75	44	291	Nov 22 Tuesday
327	4	1	7	3	3	3	5	2	8	11	21	26	11	22	7	8	9	4	7	3	13	16	1	1	196	Nov 23 Wednesday
328	8	7	1	2	6	3	4	11	2	12	9	13	14	19	24	11	5	4	6	4	8	4	6	4	187	Nov 24 Thursday
329	2	1	4	4	4	8	6	3	11	18	8	22	15	11	13	3	4	4	2	13	5	8	2	3	174	Nov 25 Friday

Table 3.5.7 (Page 1 of 4)

HFS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
330	2	7	9	7	5	5	5	4	25	15	20	12	12	13	6	8	11	4	7	19	8	3	8	3	218	Nov 26 Saturday
331	3	13	9	5	1	2	8	11	4	6	7	10	6	9	4	8	4	6	9	7	2	8	2	7	151	Nov 27 Sunday
332	8	11	9	4	4	8	0	4	5	4	6	10	8	18	15	4	4	3	9	4	1	2	2	0	143	Nov 28 Monday
333	10	5	1	11	18	11	14	6	13	26	13	9	14	15	15	13	5	1	2	4	4	1	1	5	217	Nov 29 Tuesday
334	14	8	5	6	10	6	7	11	4	2	9	7	20	18	38	27	23	16	4	14	2	3	5	8	267	Nov 30 Wednesday
335	3	3	3	5	4	2	3	14	5	9	2	11	21	38	17	14	5	0	2	4	1	9	3	0	178	Dec 01 Thursday
336	4	1	6	9	0	3	3	2	10	12	16	26	13	18	11	9	2	5	10	10	3	2	5	1	181	Dec 02 Friday
337	1	9	0	5	1	6	9	8	15	20	7	13	12	10	17	6	16	15	3	2	9	3	3	8	198	Dec 03 Saturday
338	4	3	1	7	16	10	5	14	5	3	10	3	6	5	15	1	5	7	6	5	2	5	12	7	157	Dec 04 Sunday
339	5	5	3	4	4	9	5	11	4	5	10	10	13	14	18	5	9	8	5	2	4	3	7	1	164	Dec 05 Monday
340	8	2	10	5	5	5	7	7	28	16	46	14	28	25	11	3	4	10	7	4	2	2	6	9	264	Dec 06 Tuesday
341	4	1	3	7	8	6	4	14	9	15	18	17	20	22	4	18	6	2	0	0	10	11	5	8	212	Dec 07 Wednesday
342	6	7	2	7	5	10	7	6	7	0	0	0	22	20	15	6	10	6	10	8	5	9	3	1	172	Dec 08 Thursday
343	4	5	4	3	7	8	7	9	0	12	16	15	14	27	7	13	23	19	7	9	12	16	10	12	259	Dec 09 Friday
344	2	2	7	7	6	3	17	9	3	17	11	14	7	8	4	4	25	5	8	2	1	4	6	4	176	Dec 10 Saturday
345	4	4	7	7	8	7	5	5	4	10	5	2	4	11	13	3	10	10	4	8	2	8	6	8	155	Dec 11 Sunday
346	6	3	17	12	6	12	12	6	3	13	7	9	21	28	22	45	41	35	40	32	34	49	45	48	546	Dec 12 Monday
347	48	36	3	3	8	9	15	28	3	2	19	10	11	15	18	78	73	70	70	57	21	57	116	107	877	Dec 13 Tuesday
348	96	135	105	88	11	14	15	21	21	5	10	17	17	20	18	26	55	47	93	84	101	101	78	62	1240	Dec 14 Wednesday
349	20	94	123	125	150	112	74	65	53	27	18	25	17	16	86	124	170	145	125	106	62	1	5	11	1754	Dec 15 Thursday
350	7	11	6	10	4	13	5	8	3	1	13	16	21	18	8	7	8	9	8	11	7	7	8	7	216	Dec 16 Friday
351	3	10	5	7	7	15	8	15	12	8	14	20	17	9	17	19	18	6	4	10	3	14	12	18	271	Dec 17 Saturday
352	5	8	1	4	11	12	5	2	12	8	9	15	7	13	9	9	7	12	10	5	15	6	3	12	200	Dec 18 Sunday
353	13	14	18	9	12	9	4	10	3	9	2	2	9	3	14	10	3	12	3	10	7	6	7	2	191	Dec 19 Monday
354	7	4	4	8	4	14	5	4	2	2	3	10	15	20	10	6	4	1	10	3	2	3	1	3	145	Dec 20 Tuesday
355	6	4	1	5	10	7	5	5	10	7	13	9	19	15	29	10	12	4	18	12	13	22	26	30	292	Dec 21 Wednesday
356	32	36	69	53	47	42	30	26	14	4	3	16	13	30	12	7	5	4	81	137	10	27	13	9	720	Dec 22 Thursday
357	3	4	11	7	5	4	5	8	9	13	19	18	25	15	6	6	3	2	7	3	1	3	1	4	182	Dec 23 Friday
358	4	5	4	0	2	4	11	4	5	5	4	4	6	6	4	1	8	6	4	4	53	76	50	74	344	Dec 24 Saturday
359	51	31	5	2	8	1	3	9	1	2	3	5	10	5	2	3	3	3	4	5	2	4	3	6	171	Dec 25 Sunday
360	7	3	1	7	2	2	6	10	5	2	8	2	5	13	27	64	65	15	5	8	9	4	4	7	281	Dec 26 Monday
361	5	8	8	6	8	4	5	8	16	8	13	13	6	11	19	10	6	14	9	9	10	8	5	4	213	Dec 27 Tuesday
362	4	12	39	17	33	33	36	26	34	31	36	12	48	33	27	11	13	12	13	6	11	18	25	15	545	Dec 28 Wednesday
363	6	7	5	7	6	16	4	0	1	17	4	5	24	7	8	19	4	3	7	14	5	4	6	7	186	Dec 29 Thursday
364	15	4	6	9	4	1	4	5	4	4	17	23	16	4	8	16	6	9	5	6	5	3	4	4	182	Dec 30 Friday
365	5	3	1	11	7	4	3	3	0	0	0	0	0	8	10	17	7	14	4	7	5	9	4	6	128	Dec 31 Saturday
1	5	1	5	4	6	2	2	26	8	7	3	7	9	5	3	4	6	6	3	21	15	6	13	8	175	Jan 01 Sunday
2	6	9	13	5	5	11	7	6	7	0	2	6	12	3	4	22	17	22	26	20	21	52	39	32	347	Jan 02 Monday
3	16	9	8	9	9	3	14	35	35	20	10	16	6	16	35	57	71	60	83	83	70	105	92	112	974	Jan 03 Tuesday
4	104	114	138	84	18	14	6	4	7	7	1	6	5	5	7	6	5	7	21	19	2	2	6	24	612	Jan 04 Wednesday
5	18	23	45	46	27	1	2	2	0	22	7	4	17	28	16	4	6	0	5	4	4	4	5	5	295	Jan 05 Thursday
6	5	5	6	10	7	8	7	9	6	4	12	7	17	15	12	40	59	18	9	7	5	3	16	9	296	Jan 06 Friday
7	5	9	16	6	8	9	6	8	2	9	15	7	9	14	7	8	5	5	7	9	15	2	13	3	197	Jan 07 Saturday
8	11	10	7	3	2	3	3	2	5	13	4	8	10	2	9	1	4	2	7	23	5	3	7	10	154	Jan 08 Sunday
9	7	7	5	1	21	9	3	3	7	11	19	14	10	21	26	22	14	5	14	3	2	3	9	3	239	Jan 09 Monday
10	1	6	5	2	1	3	9	4	8	4	12	0	0	0	0	0	0	0	0	0	0	0	0	0	55	Jan 10 Tuesday
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jan 11 Wednesday
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jan 12 Thursday
13	0	0	0	0	0	0	0	0	0	0	0	5	5	5	9	3	7	4	5	4	8	7	4	6	72	Jan 13 Friday
14	6	3	4	8	9	6	10	9	7	9	5	9	12	7	12	7	5	9	11	10	3	3	5	8	177	Jan 14 Saturday
15	9	11	15	11	22	26	19	12	5	8	2	5	7	42	22	23	31	40	68	76	63	67	48	12	644	Jan 15 Sunday
16	4	2	5	6	9	3	2	12	4	3	3	6	4	9	15	10	5	6	10	5	12	7	2	3	147	Jan 16 Monday
17	0	1	2	5	3	4	3	3	5	6	7	7	11	9	13	6	5	24	59	15	3	13	14	6	224	Jan 17 Tuesday
18	7	6	30	66	32	45	29	37	26	20	10	4	16	17	33	22	12	5	19	13	25	29	43	49	595	Jan 18 Wednesday
19	62	74	58	42	23	18	23	13	4	3	23	22	2	4	17	17	10	5	7	11	4	7	2	3	454	Jan 19 Thursday
20	2	5	3	8	2	8	4	40	15	5	17	5	12	7	18	13	7	1	2	2	3	6	11	11	207	Jan 20 Friday

Table 3.5.7 (Page 2 of 4)

HFS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
21	10	3	6	10	4	3	2	23	5	2	4	2	7	12	6	5	5	6	3	6	5	4	7	9	149	Jan 21 Saturday
22	12	3	6	12	3	6	12	6	5	7	8	6	10	3	4	5	4	2	6	10	11	6	3	6	156	Jan 22 Sunday
23	4	14	4	4	6	16	40	4	13	15	17	6	12	12	20	12	2	6	4	5	4	4	4	9	237	Jan 23 Monday
24	11	7	29	20	23	23	15	21	8	17	6	6	18	11	12	23	30	26	30	41	31	36	32	41	517	Jan 24 Tuesday
25	36	40	53	47	43	19	21	10	18	3	12	7	13	9	7	9	14	19	26	48	29	18	15	25	541	Jan 25 Wednesday
26	11	27	36	31	39	33	27	23	21	14	7	13	14	6	18	6	6	17	31	40	36	37	33	32	558	Jan 26 Thursday
27	47	40	60	59	40	39	20	14	25	6	7	10	13	4	12	4	14	6	14	15	24	17	23	26	539	Jan 27 Friday
28	24	44	32	34	19	11	13	5	6	7	12	12	11	9	5	4	11	8	1	8	6	4	11	9	306	Jan 28 Saturday
29	12	11	4	11	13	14	5	4	4	4	3	9	9	16	38	32	26	25	21	41	46	54	71	82	555	Jan 29 Sunday
30	82	83	77	52	17	9	9	13	10	4	4	2	2	12	14	13	11	5	19	26	24	31	33	40	592	Jan 30 Monday
31	70	35	7	39	58	61	38	31	30	8	6	8	7	18	4	11	3	4	2	5	4	7	8	7	471	Jan 31 Tuesday
32	9	10	6	2	2	8	5	5	8	14	0	3	10	6	19	17	6	2	2	1	5	11	4	3	158	Feb 01 Wednesday
33	4	3	0	8	4	3	0	5	8	5	4	6	3	12	13	5	5	2	4	14	5	11	6	5	135	Feb 02 Thursday
34	10	11	11	12	1	7	0	2	7	7	9	0	3	0	0	0	16	14	28	19	25	16	19	28	245	Feb 03 Friday
35	24	19	49	33	38	28	31	16	15	23	21	20	20	28	24	37	23	44	50	40	50	52	43	28	756	Feb 04 Saturday
36	34	42	50	35	62	31	36	40	31	17	41	25	16	18	21	19	25	20	27	21	34	19	14	41	719	Feb 05 Sunday
37	27	30	34	17	6	9	3	5	4	5	8	9	19	19	19	20	15	33	22	9	6	16	17	24	376	Feb 06 Monday
38	27	24	30	32	19	14	8	8	15	19	19	20	23	21	15	23	14	23	19	18	19	22	29	44	505	Feb 07 Tuesday
39	27	21	30	25	12	8	14	10	12	5	9	4	18	11	11	17	19	30	29	25	31	36	24	25	453	Feb 08 Wednesday
40	45	50	45	37	30	35	23	44	20	3	14	23	21	7	7	10	12	10	21	21	20	43	62	53	656	Feb 09 Thursday
41	84	70	82	85	59	43	34	40	45	18	10	7	18	4	5	17	18	9	23	27	33	42	48	53	874	Feb 10 Friday
42	70	72	105	77	81	100	103	78	68	43	34	21	9	7	8	14	7	16	44	26	45	68	36	33	1165	Feb 11 Saturday
43	9	25	4	21	13	13	15	6	14	9	13	14	14	5	3	7	8	4	1	2	6	5	6	5	222	Feb 12 Sunday
44	9	7	1	7	6	4	3	1	6	10	12	7	5	14	2	12	7	0	3	2	0	1	3	2	124	Feb 13 Monday
45	3	9	6	5	1	4	3	8	3	4	6	11	10	10	9	5	3	10	8	2	5	1	5	2	133	Feb 14 Tuesday
46	5	16	11	7	2	1	2	2	3	3	9	5	12	17	10	3	4	10	4	2	2	2	2	2	136	Feb 15 Wednesday
47	4	7	0	3	4	2	7	1	4	1	7	5	2	15	36	9	4	1	5	1	2	10	2	8	140	Feb 16 Thursday
48	8	11	9	5	2	5	5	5	3	5	9	4	8	12	16	13	8	6	14	16	7	8	6	1	186	Feb 17 Friday
49	7	16	8	1	7	9	6	5	4	2	11	2	6	10	10	8	20	33	56	60	50	36	21	46	434	Feb 18 Saturday
50	37	45	37	30	38	27	10	7	8	5	3	7	7	3	8	8	5	4	4	7	2	6	1	3	312	Feb 19 Sunday
51	5	3	3	2	8	5	13	10	9	7	3	6	17	4	12	9	12	6	22	35	14	1	5	1	212	Feb 20 Monday
52	2	44	30	5	8	4	4	3	7	32	34	6	9	2	24	17	9	4	1	6	6	11	1	4	273	Feb 21 Tuesday
53	2	1	2	6	3	7	4	5	9	0	0	0	11	26	14	21	26	12	9	23	7	10	4	8	210	Feb 22 Wednesday
54	7	6	2	3	5	28	17	13	4	14	12	14	19	20	10	11	6	3	5	2	11	19	3	2	236	Feb 23 Thursday
55	11	4	6	7	2	5	2	2	11	8	15	4	18	7	8	8	21	2	7	3	5	5	2	2	165	Feb 24 Friday
56	8	2	1	8	10	10	4	7	5	12	0	7	14	7	12	11	11	16	2	13	9	21	28	32	250	Feb 25 Saturday
57	35	101	129	105	72	67	55	33	47	26	17	17	10	3	20	71	76	87	89	63	69	99	103	104	1498	Feb 26 Sunday
58	119	102	123	117	126	92	67	45	35	32	13	11	26	6	15	5	3	1	4	1	7	0	3	5	958	Feb 27 Monday
59	4	1	2	3	1	3	2	1	4	4	12	6	15	13	1	12	0	2	0	4	0	3	1	0	94	Feb 28 Tuesday
60	2	3	6	4	3	5	0	6	6	8	10	8	8	9	8	17	10	8	2	1	11	16	12	29	192	Mar 01 Wednesday
61	44	104	122	82	55	28	42	66	26	1	6	6	17	8	12	5	8	1	1	6	5	7	3	3	658	Mar 02 Thursday
62	8	12	2	3	2	3	4	5	3	1	9	3	12	17	2	12	4	5	1	3	5	3	6	4	129	Mar 03 Friday
63	1	7	1	17	9	10	5	4	4	5	9	8	3	12	9	8	3	6	10	3	6	6	4	3	153	Mar 04 Saturday
64	3	4	4	8	7	6	9	6	8	14	3	7	7	6	8	14	3	4	5	3	8	6	5	6	154	Mar 05 Sunday
65	2	3	5	6	0	4	9	5	8	3	7	6	5	2	13	6	1	0	3	1	2	5	1	5	102	Mar 06 Monday
66	3	5	4	3	6	3	8	3	1	7	7	5	16	6	8	4	5	4	3	2	1	2	4	4	114	Mar 07 Tuesday
67	2	2	10	14	4	9	2	10	7	6	4	9	6	7	11	14	7	12	2	1	1	4	7	7	158	Mar 08 Wednesday
68	22	31	30	17	5	0	3	10	7	7	9	3	21	2	8	13	2	4	9	4	7	5	1	6	226	Mar 09 Thursday
69	4	17	26	15	15	25	17	14	16	12	11	6	15	8	7	12	2	4	10	16	43	41	16	23	375	Mar 10 Friday
70	57	88	108	34	4	9	5	2	18	7	5	12	5	4	5	14	3	2	4	4	5	7	8	4	414	Mar 11 Saturday
71	4	3	4	3	13	7	1	5	3	6	5	3	3	2	2	5	1	10	3	7	19	4	5	1	119	Mar 12 Sunday
72	2	1	6	1	1	5	2	5	3	6	5	6	8	5	8	6	7	5	5	3	4	7	1	5	107	Mar 13 Monday
73	6	1	3	8	3	8	4	3	4	2	9	1	12	18	18	12	8	17	7	5	8	12	15	28	212	Mar 14 Tuesday
74	22	22	42	36	38	39	16	18	10	6	5	17	9	19	13	14	26	25	30	41	12	4	3	4	471	Mar 15 Wednesday
75	2	3	0	7	7	7	9	7	9	10	7	5	12	10	11	12	21	6	3	4	3	4	14	5	178	Mar 16 Thursday
76	3	3	2	3	4	4	1	3	8	6	10	8	11	35	7	4	9	11	4	5	1	4	5	16	167	Mar 17 Friday

Table 3.5.7 (Page 3 of 4)

HFS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
77	1	7	1	2	4	4	4	11	4	12	46	9	4	1	10	7	5	4	13	2	3	2	3	7	166	Mar 18 Saturday
78	6	4	4	1	13	8	4	0	3	2	4	5	6	3	21	5	9	12	6	5	1	3	6	5	136	Mar 19 Sunday
79	12	5	9	29	17	22	28	16	8	3	28	11	3	7	13	9	7	4	7	14	44	53	50	32	431	Mar 20 Monday
80	32	17	8	4	12	20	10	11	7	8	8	21	37	12	9	5	12	2	1	2	6	9	14	16	283	Mar 21 Tuesday
81	25	28	37	27	7	16	10	11	8	26	68	59	47	17	6	4	6	2	3	3	13	2	6	1	432	Mar 22 Wednesday
82	1	1	2	1	5	15	13	43	18	45	37	26	92	46	8	11	2	9	2	3	3	0	9	4	396	Mar 23 Thursday
83	98	58	92	36	21	52	39	46	70	63	22	10	8	6	5	9	2	3	4	2	2	3	1	4	656	Mar 24 Friday
84	3	0	1	4	0	3	2	1	1	0	9	5	4	4	5	3	0	3	2	3	7	7	0	10	77	Mar 25 Saturday
85	6	12	24	14	34	43	15	80	71	75	95	94	92	5	3	4	3	4	6	1	4	3	2	1	691	Mar 26 Sunday
86	3	1	1	1	3	75	56	44	48	36	40	10	7	10	8	7	1	3	10	1	1	4	7	6	383	Mar 27 Monday
87	5	9	14	11	8	52	99	98	29	71	88	65	69	75	34	2	3	1	5	7	7	7	6	4	769	Mar 28 Tuesday
88	5	1	79	88	85	39	51	45	54	37	48	55	76	51	4	2	6	4	4	8	12	14	20	24	812	Mar 29 Wednesday
89	26	28	24	23	26	26	62	64	60	90	78	76	61	5	14	17	4	3	5	4	2	9	7	2	716	Mar 30 Thursday
90	3	4	2	8	34	67	77	60	63	63	43	85	76	58	64	52	50	31	2	2	1	1	2	3	851	Mar 31 Friday
HFS	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum	2407	2660	2985	2707	2418	2380	2253	2302	2118	2186	2440	2303	2751	2503	2578	2509	2239	1959	2219	2162	2053	2241	2199	2279	56851	Total sum
177	14	15	17	15	14	13	13	13	12	12	14	13	16	14	15	14	13	11	13	12	12	13	12	13	321	Total average
127	14	15	17	16	13	13	13	13	12	12	14	13	17	15	16	15	13	11	12	12	10	12	12	12	321	Average workdays
50	12	14	16	14	14	13	12	12	12	12	13	12	11	10	11	12	12	11	13	13	15	15	13	14	304	Average weekends

Table 3.5.7. (Page 4 of 4) Daily and hourly distribution of Hagfors array detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day

3.6 IMS operation

The Intelligent Monitoring System (IMS) was installed at NORSAR in December 1989 and was operated at NORSAR from 1 January 1990 for automatic processing of data from ARCESS and NORESS. A second version of IMS that accepts data from an arbitrary number of arrays and single 3-component stations was installed at NORSAR in October 1991, and regular operation of the system comprising analysis of data from the 4 arrays ARCESS, NORESS, FINESS and GERESS started on 15 October 1991. As opposed to the first version of IMS, the one in current operation also locates events at teleseismic distance.

Data from the Apatity array were included on 14 December 1992, and from the Spitsbergen array on 12 January 1994. Detections from the Hagfors array were available to the analysts and could be added manually during analysis from 6 December 1994. After 2 February 1995, Hagfors detections were also used in the automatic phase association.

The operational stability of IMS has been very good during the reporting period. In fact the IMS event processor (pipeline) has had no downtime of its own; i.e., all data available to IMS have been processed by IMS.

Phase and event statistics

Table 3.6.1 gives a summary of phase detections and events declared by IMS. From top to bottom the table gives the total number of detections by the IMS, the number of detections that are associated with events automatically declared by the IMS, the number of detections that are not associated with any events, the number of events automatically declared by the IMS, the total number of events defined by the analyst, and finally the number of events accepted by the analyst without any changes (i.e., from the set of events automatically declared by the IMS)

Due to reductions in the FY94 funding for IMS activities (relative to previous years), new criteria for event analysis were introduced from 1 January 1994. Since that date, only regional events in areas of special interest (e.g, Spitsbergen, since it is necessary to acquire new knowledge in this region) or other significant events (e.g, felt earthquakes and large industrial explosions) were thoroughly analyzed. Teleseismic events were analyzed as before.

To further reduce the workload on the analysts and to focus on regional events in preparation for Gamma-data submission during GSETT-3, a new processing scheme was introduced on 2 February 1995. The GBF (Generalized Beamforming) program is used as a pre-processor to IMS, and only phases associated to selected events in northern Europe are considered in the automatic IMS phase association. All detections, however, are still available to the analysts and can be added manually during analysis.

The effect of the GBF pre-processing scheme is clearly shown in Table 3.6.1. where the monthly number of “Events automatically declared by the IMS” drops from 10,000 in Oct-Jan to less than 4,000 in Feb-Mar.

There is one exception to the new rule for automatic phase association: all detections from the Spitsbergen array are passed directly on to the IMS. This allows for thorough analysis of all events in the Spitsbergen region.

	Oct 94	Nov 94	Dec 94	Jan 95	Feb 95	Mar 95	Total
Phase detections	71319	74692	84959	97918	78970	83580	491438
- Associated phases	10926	9102	10104	9561	3636	3970	47299
- Unassociated phases	60393	65590	74855	88357	75334	79610	444139
Events automatically declared by IMS	3157	2744	2907	2839	892	920	13459
No. of events defined by the analyst	1102	420	411	198	205	181	2517
No. of events accepted without modifications	0	0	3	0	0	0	3

Table 3.6.1. IMS phase detections and event summary.

U. Baadshaug
B. Ferstad
B.Kr. Hokland
L.B. Loughran
B. Paulsen

3.7 System response for the Spitsbergen array

The Spitsbergen array is located at 78.18N, 16.37E, and comprises 9 sites within a diameter of 1 km. The array started operations November 6, 1992, with one vertical S-500 seismometer at each site. August 30, 1994, the S-500s were replaced with Guralp CMG-3ESP. These instruments were reinstalled on 18 October 1994 with a change to 10 times more gain.

This section describes the response as of 18 October 1994 (see Fig. 3.7.1).

At the central site, A0, a broadband CMG-3T seismometer was installed on 18 October 1994. This instrument did not operate correctly and was again reinstalled in May 1995 (see Fig. 3.7.2).

The digitizers used at Spitsbergen are Nanometrics RD6 version 1625. The digital data output from Nanometrics RD3/RD6 digitizers has approximately a 2.5 sec time delay. A one-second buffer is collected. Then this one-second buffer is filtered with an FIR filter, resampled and transmitted with a total 2 sec delay plus FIR filter time delay. The 2 sec time delay is corrected by the NORAC data acquisition system. The remaining FIR filter time delay is corrected by the NORSAR dp/ep ARRMAN read routines. This means that all data presented by dp/ep software are time corrected. All data converted to CSS format by NORSAR software are time corrected. All data used by NORSAR AlphaRead and AlphaSend software are time corrected. All data present on NORSAR exabyte and tape image files are **not** corrected for FIR filter time delay, as this is done by the read routines. This is important to know if a response that includes the FIR filter is used for removal of system response in time domain. If so, the FIR filter time delay will be introduced one more time.

The velocity response output for Guralp CMG-3ESP serial numbers V3135 - V3144, work order 0356, is described by 6 poles and 2 zeroes, all given with unit Hz.

The poles are:

-70.7e-03+/-j70.7e-03, -43.2+/-j38.6, -150, -190

The 2 zeroes are 0,0, and the normalizing factor at 1 Hz is A=95.48e+06 for velocity. Displacement is obtained by adding one zero and multiplying A with 2π since poles are in Hz with s = jf.

The sensitivity is 2*5000 V/m/s, and the velocity response is flat between 100 millihz and 50 Hz. Fig. 3.7.3 shows the total system response including all filters in Fig. 3.7.1.

The velocity response output for Guralp CMG-3T serial number (T321) is described by 4 poles and 3 zeroes, all given with unit Hz.

The poles are:

-7.07e-03+/-j7.07e-03, -80.5+/-j30.8, 150

The 3 zeroes are 0,0,150.5, and the normalizing factor at 1 Hz is A=-49.5. (Note negative).

The sensitivity is 2*5000 V/m/s, and the velocity response is flat between 10 millihz and 50 Hz. Fig. 3.7.4 shows the total system response including all filters in Fig. 3.7.2.

See Fyen(1995) for a complete description of the evaluation of the system response for Spitsbergen and other systems installed at NORSAR.

The Guralp CMG3-T seismometer was installed for a period of 7 days together with the KS54000P in the same vault as NORESS KS36000 seismometer. Data from the Guralp and KS54000P broadband seismometers have been converted to NORESS system response both in the NORESS KS36000 LP band and the NORESS GS-13 SP band, and the given response is confirmed (see Fig. 3.7.5).

J. Fyen

References

Fyen, J. (1995) NORSAR System Responses.NORSAR Technical Report, May 1995, Kjeller Norway.

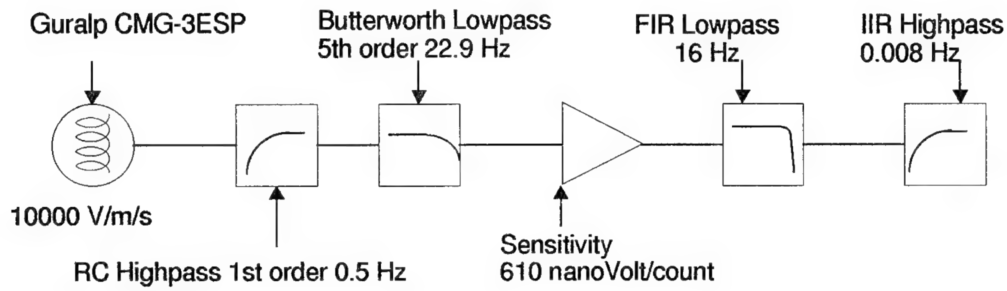


Fig. 3.7.1 Spitsbergen Guralp GMG3-ESP electronics block diagram. The filters are within Nanometrics RD6 digitizer. Two analog and two digital filters are used. The basic oversampling rate is 160 Hz, which is reduced to 40 Hz in the FIR filter stage.

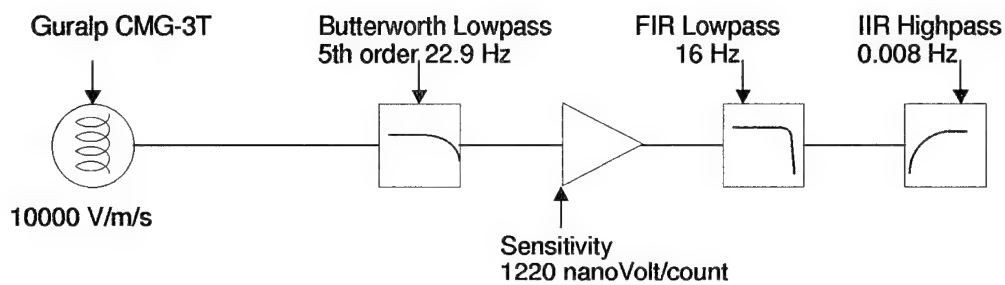


Fig. 3.7.2 Spitsbergen Guralp GMG3-ESP electronics block diagram. The filters are within Nanometrics RD6 digitizer. One analog and two digital filters are enabled. The basic oversampling rate is 160 Hz, which is reduced to 40 Hz in the FIR filter stage.

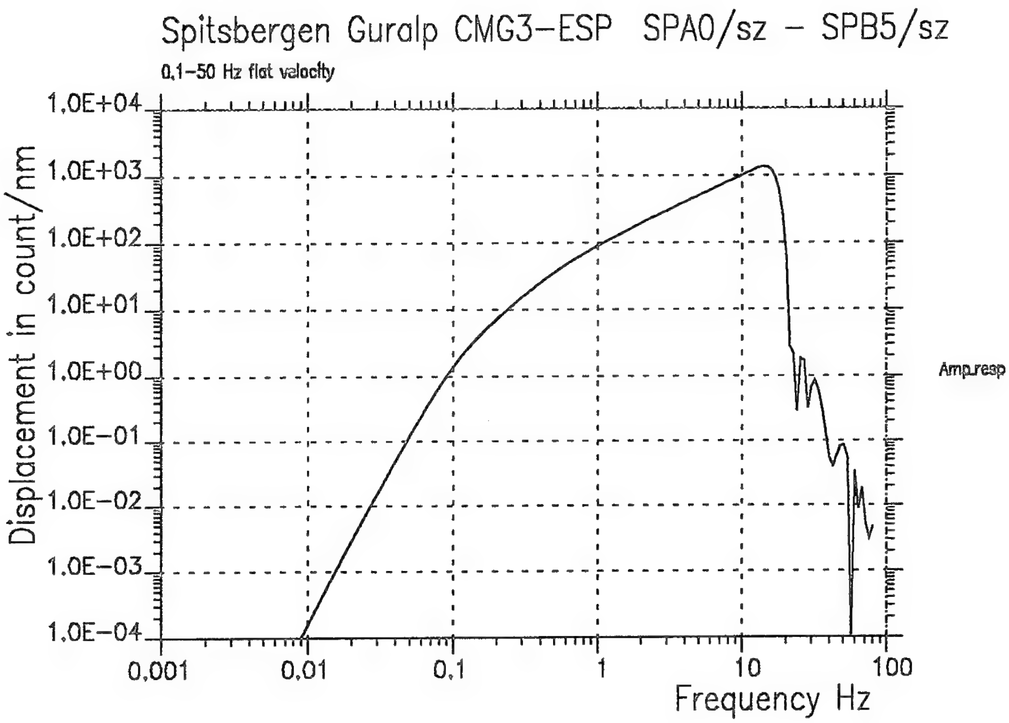


Fig. 3.7.3. Spitsbergen amplitude response for Guralp CMG3-ESP plus RD6 digitizer.

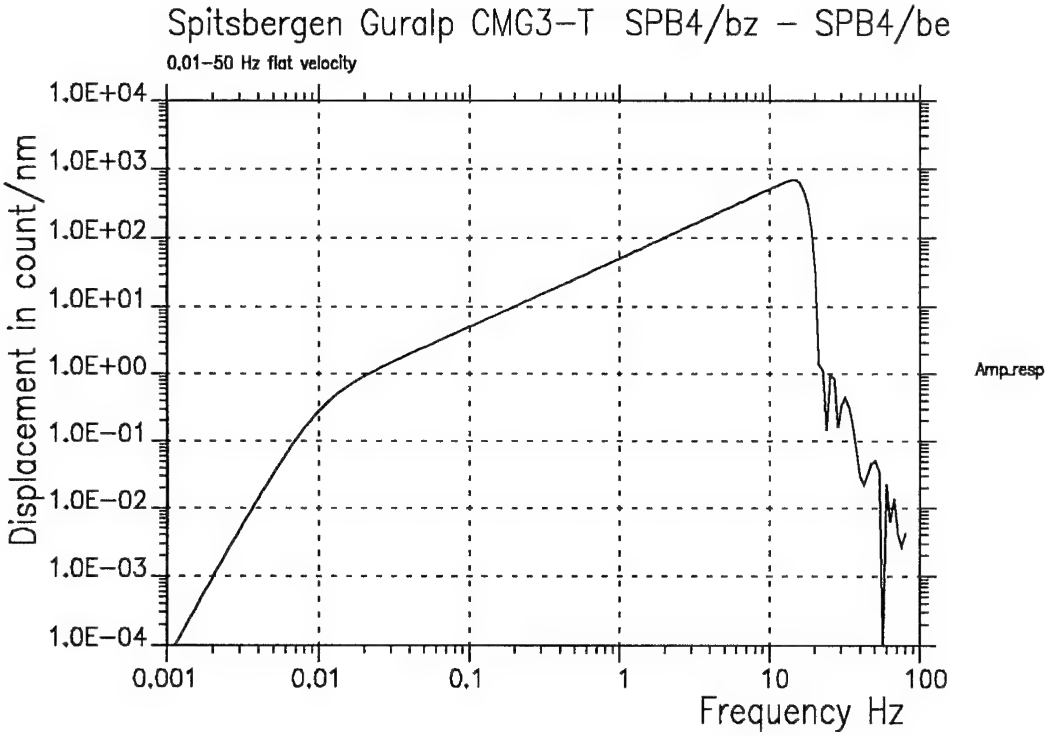


Fig. 3.7.4. Spitsbergen system amplitude response for Guralp CMG3-T plus RD6 digitizer. The site is SPB4/bz,bn,be.

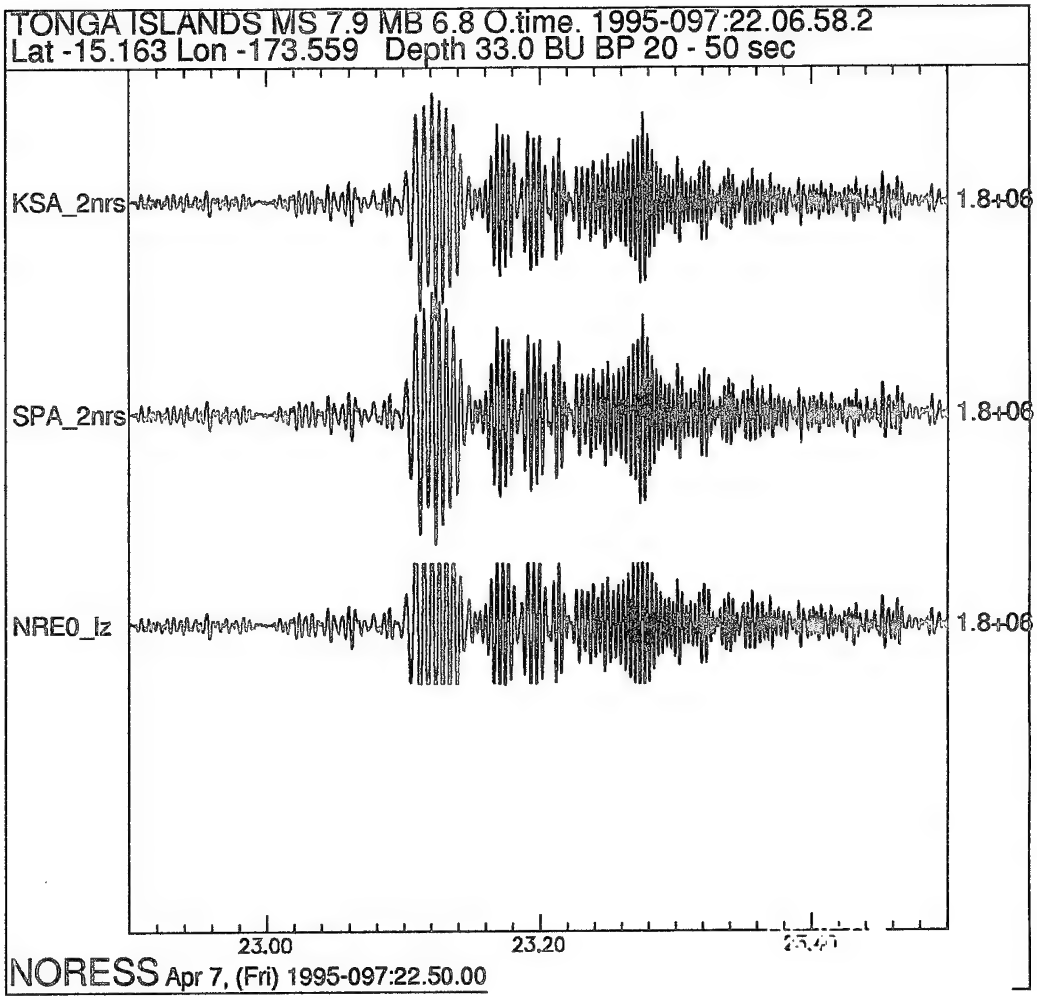


Fig. 3.7.5. Verification of system response. The three traces show one hour of data with surface waves from a Tonga Island earthquake. The lower trace is original NORESS LP band data from KS36000. The KSA_2nrs upper trace is K54000P seismometer data converted to NORESS LP response. The middle trace is Guralp CMG3-T seismometer data converted to NORESS LP response. All traces are in the same scale. The NORESS LP data are clipped.

4 Improvements and Modifications

4.1 NORSAR

NORSAR data acquisition

On October 5, 1994, the installation of a new data acquisition system began, following the delivery of Science Horizons digitizer AIM24 with communication interface CIM-II together with the XAVE data acquisition software.

The first installation was made at subarray 06C in order to field test the delivered system. Fig. 4.1.1 is a block diagram of the installation in the Central Terminal Vault — CTV — of each subarray.

The CIM II collects data frames from six AIM24-1 and one AIM24-3. The communication between CIM II and AIM24 uses a 4-wire full duplex 9600-baud synchronous SDLC (ADCCP) protocol. The communication between CIM II and the data center also uses a 4-wire full duplex 9600-baud synchronous SDLC protocol.

The original NORSAR HS-10 short period seismometers were installed in boreholes in Short Period Vaults — SPVs. Between the CTV and 5 SPVs (SP01-SP05) of each of the 7 subarrays there are buried cables of lengths 5 - 10 km. The 6th (SP00) short period instrument of each subarray was installed in a Long Period Vault — LPV — located adjacent to the CTV. In each of the LPVs a three-component long period seismometer was also originally installed. These instruments began to be replaced in January 1995. See NORSAR Sci.Rep No. 2-93/94 for a detailed description of the SPVs and LPVs. New Teledyne Geotech broadband seismometers KS54000P were delivered in January 1995.

In the original installation, the signals from the seismometer were transmitted in analog form to the CTV. The refurbishment involves moving the digitizer process out to the remote SPV, so that time-tagged digital data can be transmitted back to the CTV. This is performed by installing a digitizer and a GPS clock at every SPV and LPV. These units require DC power which has to be delivered through the buried cables. To find digitizers, GPS clocks and modems that require very low power has been the greatest challenge of the refurbishment project. See Fig. 4.1.2 for a block diagram of the SPV electronics.

After the delivery of digitizers it was decided that the HS-10 seismometers should be replaced with Teledyne Geotech 20171-0102 short period instruments together with Brick amplifiers 57010-0105. This added another complication to the power budget, and the installation plan had to be revised. The new SP seismometers were ordered in January and are to be delivered in August 1995.

It was decided to install two remote AIM24s in subarray 06C before the winter for a long-term test of the power and communication capability between CTV and SPV. During the winter period, we have successfully operated these two remote sites within 06C. The cable lengths are up to 14 km.

It soon turned out that a longer field test with the new modems and batteries in the SPVs was necessary. Improvements have been made, and the test installation has given necessary experience for building the components for the remainder of the array.

We experienced initially some minor problems with the XAVE data acquisition system and these problems were fixed. After a two-month test period, we decided to install the rest of the Science Horizons equipment. It was not possible to do the SPV installation during the winter, so all the AIM24s for each subarray were installed in the CTV. This gave us more experience with XAVE due to more data, and we now have an operational data acquisition system that works well. However, the AIM24s and GPS clocks are still in the CTV for all subarrays except 06C. See Table 4.1 for a description of the subarray sites and start date of operating the new data acquisition system.

After a test period we agreed with Science Horizons to return the AIM24-3 digitizers for some modifications. These three-channel digitizers are designed for operation with broadband seismometers, and the long period noise level was found to be high. The digitizers were returned at the end of January 1995, and Science Horizons is still trying to improve the performance.

A new KS54000P was installed in subarray 06C in April 1995.

The communication link between the CTVs and NDPC is based partially on NORSAR-owned buried cables and partially on the Norwegian Telecom telephone network. There have been numerous cases of data outage due to phone line problems, and a replacement of these communication links is planned. Testing of a VSAT system has been performed, and the CIM will be able to transmit data over VSAT satellite links rather than land lines.

During the reporting period, the NORSAR data acquisition system has been operating satisfactorily, with only occasional outages in connection with the tests described above.

NORSAR detection processing

The NORSAR detection processor has been continuously updated to adjust for the developments of the data acquisition system, and has been running satisfactorily. To maintain consistent detection capability, the NORSAR beam tables have not been changed.

Detection statistics for the NORSAR array are given in section 2.

NORSAR event processing

The routine processing of NORSAR events was described in NORSAR Sci. Rep No 2-93/94. The process continues to use a data base with time delay corrections and slowness corrections for location calibration that was established in 1974 (Berteussen, 1974). This data base still gives valuable corrections for the NORSAR array, but the data base itself is technically based on old IBM architecture disk files. The correction subroutines and disk file access routines have been converted to give identical results on SUN and the old IBM sys-

tem. Chapter 7.3 describes preliminary results for establishing a new time delay correction data base.

A detailed report on NORSAR processing techniques has been developed. (Fyen, 1995).

J. Fyen

References:

Berteussen, K.A. (1974): NORSAR Location calibrations and time delay corrections, NORSAR Scientific Report No. 2-73/74, Kjeller, Norway.

Fyen, J. (1995): Time delay measurements and NORSAR large array processing, Kjeller, Norway.

Subarray	ISC code	Substations	Modified (date, time)	Location of AIM
01A	NAO	NA1-01,...,NA1-05	1994-356:12	CTV
01B	NBO	NB1-01,...,NB1-05	1995-053:13	CTV
02B	NB2	NB2-01,...,NB2-05	1994-340:08	CTV
02C	NC2	NC2-01,...,NC2-05	1994-343:11	CTV
03C	NC3	NC3-01,...,NC3-05	1994-355:10	CTV
04C	NC4	NC4-01,...,NC4-05	1994-354:13	CTV
06C	NC6	NC6-01,...,NC6-05	1994-278:08	SPV

Table 4.1.1. NORSAR refurbishment status. The table shows original subarray names, ISC codes of center instrument in each subarray, ISC names of each of the 5 remote sites, date from which new data (with AIM digitizers) is available, location of digitizers.

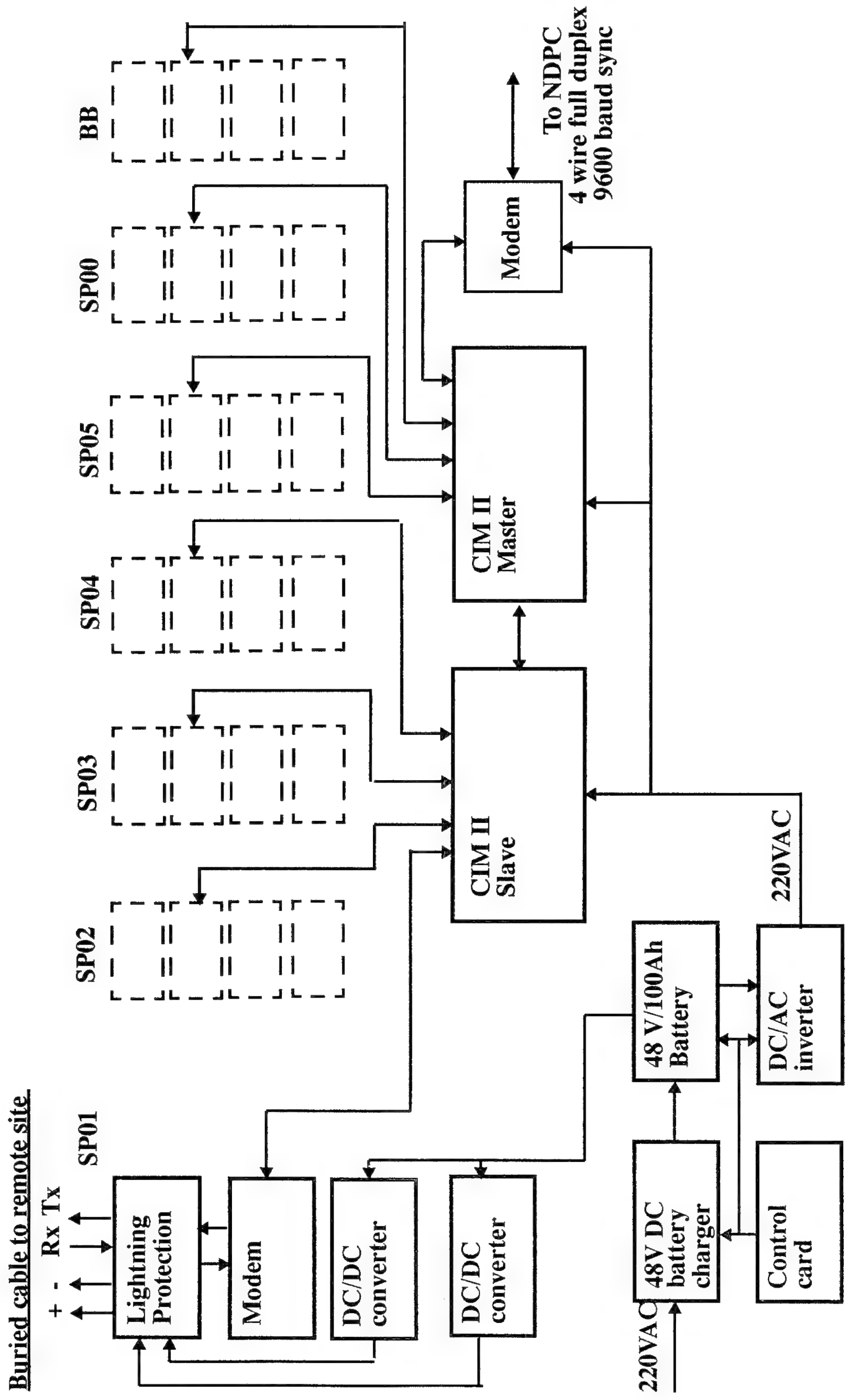


Fig. 4.1.1. Block diagram for CTV electronics.

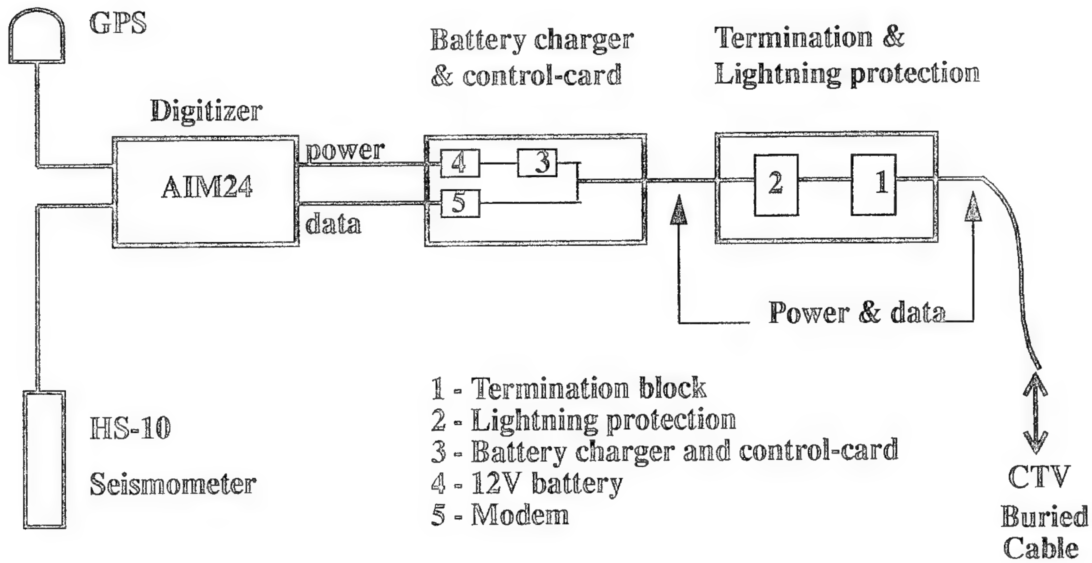


Fig. 4.1.2. Schematic illustration of remote SPV electronics. The buried cable between the SPV and the CTV is used for both power and data. The GPS antenna is installed outside the vault, inside a vertical PVC sewage pipe with a lid. The three boxes with electronics all fit into the original zinc-tank vaults.

5 Maintenance Activities

Activities in the field and at the Maintenance Center

This section summarizes the activities at the Maintenance Center (NMC) Hamar, and includes activities related to monitoring and control of the NORSAR teleseismic array, as well as the NORESS, ARCESS, FINESS, GERESS, Apatity, Spitsbergen and Hagfors small-aperture arrays.

Activities involve preventive and corrective maintenance, planning and activities related to the refurbishment of the NORSAR teleseismic array.

NORSAR

Visits to subarrays in connection with:

- Installed Science Horizons equipment in the subarray vaults and prepared boreholes for the broadband seismometers
- Drilled boreholes at 01B, 02C and 04C
- Cleaned LPVs after drilling at 01B, 02B, 02C, 03C and 04C
- Sandblasted concrete floors at LPVs
- LPV construction maintenance at all subarrays
- Replaced Nanometrics RD6 data collection devices with AIM24 and CIM2 systems from Science Horizons
- Replaced RA-5 amplifiers
- Disconnected AIM24-BB at 01A, 02B, 02C, 03C, 04C and 06C. These were returned to NMC and sent to USA for modification.
- Installed Guralp broadband instrument and Teledyne KS54000 in boreholes, LPV 06C, for testing

NMC

- Continued the NORSAR refurbishment work

NORESS

- Repaired fiber optical links C5, C6, D4 and D5
- Installed A0 after LPV construction maintenance
- Drained water out of D5 vault after leakage through cable entrance pipe

Spitsbergen

- Charged batteries and replaced a defective windmill (November 94)

Hagfors

- Repaired loose connection on 220V AC power cable (January 95)

Additional details for the reporting period are provided in Table 5.1.

P.W. Larsen
K.A. Løken

Subarray/ area	Task	Date
	October 1994	
NORSAR	NORSAR refurbishment work continued, with installation of Science Horizons equipment in the subarray vaults and preparation of boreholes for the broadband seismometers. Experimental testing of VSAT-transmission from one subarray has continued.	October
NMC	NORSAR refurbishment work continued .	October
	November 1994	
NORSAR		
01B	Drilled borehole Cleaned LPV after drilling	14-15/11 21-24/11
02B	Cleaned LPV after drilling	21-24/11
02C	Drilled borehole Cleaned LPV after drilling Changed polarity of 02C05	10-11/11 14/11 14/11
03C	Cleaned LPV after drilling	21-24/11
04C	Drilled borehole Cleaned LPV after drilling	1-2/11 21-24/11
06C	Started sandblasting the LPV	30/11
Sptisbergen	Charged batteries and replaced windmill. Low battery voltage because of failure of windmill.	16-18/11
NMC	Continued NORSAR refurbishment work	November
	December 1994	
NORSAR		
01A	Drilled borehole Prepared LPV for sandblasting. SP01 instrument in LPV was disconnected and removed from LPV due to sandblasting	15-16/12 20/12

Subarray/ area	Task	Date
01A	Sandblasted LPV and primed metal parts Replaced Nanometrics RD6 data collection device with AIM24 and CIM2 system from Science Horizons. Reinstalled SP instrument in LPV. Replaced modem	21/12 22/12 23/12
01B	LPV prepared for sandblasting. SP06 instrument in LPV was disconnected and removed from LPV due to sandblasting. Replaced RA-5 SP02 Sandblasted LPV and primed metal parts	12/12 12/12 12/12
02B	LPV prepared for sandblasting. SP01 instrument in LPV was disconnected and removed from LPV due to sandblasting. Sandblasted LPV and primed metal parts Replaced Nanometrics RD6 data collection device with AIM24 and CIM2 system from Science Horizons Reinstalled SP instrument in LPV	14/12 15/12 8/12 21/12
02C	LPV prepared for sandblasting. SP01 instrument in LPV was disconnected and removed from LPV due to sandblasting. Sandblasted LPV and primed metal parts Replaced Nanometrics RD6 data collection device with AIM24 and CIM2 system from Science Horizons	9/12 9-10/12 9/12
03C	LPV prepared for sandblasting. SP03 instrument in LPV was disconnected and removed from LPV due to sandblasting. Sandblasted LPV and primed metal parts Replaced Nanometrics RD6 data collection device with AIM24 and CIM2 system from Science Horizons. Reinstalled SP instrument in LPV	12/12 14/12 21/12
04C	LPV prepared for sandblasting. SP05 instrument in LPV was disconnected and removed from LPV due to sandblasting. Sandblasted LPV Replaced Nanometrics RD6 data collection device with AIM24 and CIM2 system from Science Horizons. Reinstalled SP instrument in LPV	13/12 13/12 20/12
06C	LPV construction maintenance	16-19/12
NMC	Continued NORSAR refurbishment work	December

Subarray/ area	Task	Date
January 1995		
NORSAR		
01A	Disconnected AIM24-BB. Returned to NMC for shipment to USA for modification	25/1
02B	Disconnected AIM24-BB. Returned to NMC for shipment to USA for modification	24/1
02C	Replaced RA-5 amplifier SP01 channel. Reinstalled SP04 in LPV after sandblasting Disconnected AIM24-BB. Returned to NMC for shipment to USA for modification	3/1 25/1
03C	Disconnected AIM24-BB. Returned to NMC for shipment to USA for modification Replaced RA-5 amplifier SP01 channel Replaced RA-5 amplifier SP02 channel	24/1 23/1 26/1
04C	Disconnected AIM24-BB. Returned to NMC for shipment to USA for modification Replaced RA-5 amplifier SP02 channel LPV construction maintenance	24/1 26/1 30/1
06C	Construction maintenance at LPV Disconnected AIM24-BB. Returned to NMC for shipment to USA for modification	4-5/1 24/1
NORESS	Repaired fiber optical link D4	2/1
	Repaired fiber optical link D5	5/1
	Repaired fiber optical link C5 and C6. Installed A0 after LPV construction maintenance. Drained water out of D5 vault after leakage through cable entrace pipe	6/1
Hagfors	Repaired loose connection on 220V AC power cable	13/1
NMC	Continued NORSAR refurbishment work	January

Subarray/ area	Task	Date
February 1995		
NORSAR		
01A	LPV construction maintenance	13/2
	LPV construction maintenance	24/2
01B	LPV construction maintenance	2/2
	LPV construction maintenance. Disconnected SP06 in LPV due to maintenance. Replaced Nanometrics RD6 data collection device with an AIM24 and CIM2 system from Science Horizons	21/2
	LPV construction maintenance. Reinstalled SP06	23/2
02B	LPV construction maintenance	6/2
	Visited 02B because no data received from site. Power line failure	28/2
02C	LPV construction maintenance	9/2
	LPV construction maintenance. Disconnected SP04 in the LPV due to maintenance	16/2
	LPV construction maintenance. Reinstalled SP04	17/2
03C	LPV construction maintenance	1/2
04C	LPV construction maintenance. Disconnected SP05 in the LPV due to maintenance	20/2
	LPV construction maintenance. Reinstalled SP05.	21/2
	Visited 04C because no data received from site. Data line failure	27/2
NMC	Continued NORSAR refurbishment work.	February
March 1995		
NORSAR		
01A	LPV construction maintenance	6-10/3
02B	LPV construction maintenance	6-10/3
	SP01 in LPV disconnected due to construction maintenance	7-8/3
02C	Repaired noisy SP04 channel	1/3

Subarray/ area	Task	Date
03C	LPV construction maintenance SP01 in LPV disconnected due to construction maintenance	6-10/3 9-10/3
06C	Installed Guralp broadband instrument and Teledyne KS54000 in boreholes, LPV, 06C, for testing	29-30/3
NMC	Continued the NORSAR refurbishment work	March

Table 5.1. Activities in the field and the NORSAR Maintenance Center, including NDPC activities related to monitoring and control of the NORSAR array, as well as the NORESS, ARCESS, FINESS, GERESS, Apatity, Spitsbergen and Hagfors small-aperture arrays during 1 October 1994 - 31 March 1995.

6 Documentation Developed

Fyen, J. (1995): NORSAR large array processing and time delay measurements, This volume.

Harjes, H.-P., M. Jost & J. Schweitzer (1994): Preliminary calibration of candidate alpha stations in the GSETT-3 network, *Ann. Geof.*, XXXVII, 383-396.

Kremenetskaya, E.O., V.E. Asming & F. Ringdal (1995): Study of underground mining explosions in the Khibiny Massif, This volume.

Kuzmin, I., Y.V. Fedorenko, A.I. Grachev, S.N. Kulitchkov, O. Raspopov & F. Ringdal (1995): Initial results of a newly installed acoustic array in Apatity, This volume.

Kværna, T. & F. Ringdal (1995): Magnitude estimation using the IDC Threshold Monitoring system, This volume.

Mykkeltveit, S., U. Baadshaug & T. Kværna (1995): Processing of Spitsbergen array data, This volume.

Ringdal, F., T. Kværna & S. Mykkeltveit: Global seismic threshold monitoring and automated network processing. Paper presented at the ARPA CTBT Monitoring Technologies Conf. 1995. Also in this volume.

Schweitzer, J. & T. Kværna (1995): Mapping of azimuth anomalies from array observations, This volume.

Semiannual Tech. Summary, 1 Apr - 30 Sep 94, NORSAR Sci. Rep. 1-94/95, NORSAR, Kjeller, Norway.

7 Summary of Technical Reports / Papers Published

7.1 Global seismic threshold monitoring and automated network processing

Paper presented at the ARPA CTBT Monitoring Technologies Conference 1995

Abstract

The overall objective of the research conducted at NORSAR is to develop, test and demonstrate advanced automated processing techniques for use in a global seismic CTBT monitoring system, and to implement and integrate these techniques into the processing at the International Data Center. A global system for continuous seismic threshold monitoring has been developed and implemented at the IDC. Other advances include improved automatic onset time estimation of signal arrivals, special post-processing procedures for improving automatic event location accuracies and on-line regional generalized beamforming for reliable phase association of detected seismic events.

Background

Over the past several years, major advances have been made in automated processing of seismic data for regional and global monitoring. These range from automated array and 3-component station detection processing and parameter extraction using techniques such as frequency-wavenumber analysis to automated, expert-system processing at both the single-station and network level. Advances have also been made in regional and global phase association techniques. Nevertheless, the current IDC processing requires a high degree of analyst interaction before the final bulletin is produced. While the current interactive analysis tools at the IDC are both sophisticated and effective, the need for further automation of the analyst functions is clearly present. Such added automation would also contribute to enabling the analysts to focus on events of special interest, rather than spending the majority of their time on routine events.

Global threshold monitoring

Our main emphasis has been on developing and implementing a system for global continuous threshold monitoring at the IDC. Continuous seismic threshold monitoring (CSTM) is a technique that has been developed over the past few years to monitor a geographical area continuously in time. Data from a network of arrays and single stations are combined and "steered" toward a specific area to provide an on-going assessment of the upper magnitude of seismic events that might have occurred in that area.

The main purpose of the technique is to highlight instances when a given threshold magnitude is exceeded, thereby helping the analyst to focus on those events truly of interest in a monitoring situation. The analyst can then apply traditional tools in detecting, locating and

identifying the source of the disturbance. Thus, the CSTM technique is designed to supplement, not to supplant, traditional techniques.

Approaches to CSTM include:

- Site-specific monitoring: A seismic network is focused on a small area, such as a known test site. This narrow focusing enables a high degree of optimization, using site-station specific calibration parameters and sharply focused array beams.
- Regional monitoring: Using a dense geographical grid, and applying site-specific monitoring to each grid point, threshold contours for an extended region are computed through interpolation. In contrast to the site-specific approach, it is usually necessary to apply generic attenuation relations, and the monitoring capability will therefore not be quite as optimized.
- Global monitoring: This is similar to regional monitoring, but the global grid system is much less dense, and the threshold parameters are most often determined from teleseismic (rather than regional) phases. This approach is expected to be particularly useful at the IDC in a monitoring system.

The CSTM approach has an advantage over standard capability maps in the following respects:

- The threshold levels represent the actual noise conditions at any point in time, and do not depend upon an assumed noise distribution.
- After a large earthquake, the ensuing increase in global threshold levels is accurately represented.

These features are illustrated in Figs. 7.1.1-7.1.4.

Generalized beamforming

Another area of activity has been the development and fine-tuning of regional generalized beamforming (GBF) for the Fennoscandian area. Based upon statistics accumulated over the past several years, it is found that this technique is very effective in providing reliable phase association and initial location estimates, for use in subsequent processing by the Intelligent Monitoring System (IMS). The results from the GBF process are now available on-line on the Internet (finger quake@ugle.norsar.no).

The following specific results have been obtained:

- The Alpha station network in Fennoscandia (NORESS, ARCESS, FINESS, Hagfors) detects thousands of regional events annually.
- More than 95 per cent of these events are man-made.
- Most events are confined to a small number of mining regions.
- Typical location accuracy (after analyst review) is about 10 km.
- Very few man-made events (only about 10 per year) exceed $m_b = 3$.

Fig. 7.1.5 illustrates the principles of regionalized GBF and the results obtained.

Automatic post-processing

An experiment has been conducted for one of the most active mining regions, located on the Kola Peninsula. The small array in Apatity, Kola, located less than 50 km from this area, has been used as a Beta station in an automatic processing scheme. We have also used a 3-component station nearby. Results are as follows:

- By autoregressive techniques, and applying fixed filter bands and processing parameters, an onset time accuracy comparable to analyst picks has been achieved.
- Automatic relocation of the events using the Beta stations has resulted in a significantly improved accuracy (about 2 km) in epicenter location.
- These results have been confirmed by independent "ground truth" locations provided by the Kola Science Centre.

The results of this experiment are illustrated in Fig. 7.1.6.

An important perspective is that suitably placed Beta stations near mining areas could be used to obtain improved automatic location accuracy of mining events, and could reduce analyst workload considerably. While our work has made use of a small Beta-array, a 3-component station might be expected to provide nearly as good results when processed in this manner.

Another important result of years of monitoring seismic events in Fennoscandia is the virtual absence of mining explosions exceeding $m_b = 3.0$. Also, very few of the events exceed $m_b = 2.5$. If such mining practice is typical, it might be important in reducing the number of events of real monitoring concern.

We are currently applying the autoregressive onset estimation technique to seismic phases on a more general basis, and investigating the quality of the results as a function of filter setting and signal-to-noise ratio. Reliable quality indicators are the key to a successful application of the post-processing technique in a wider context. One important consideration is to obtain the appropriate weighting of the observations in the location scheme, such that reliably determined arrival times will be given far higher weights than less reliable ones.

Conclusions and recommendations

The Continuous Seismic Threshold Monitoring has been demonstrated to provide a simple and very effective tool in day-to-day monitoring of a site of particular interest, and thereby offers a valuable supplement to traditional techniques in nuclear test ban monitoring. The initial version of this system has now been implemented at the IDC.

The future work will concentrate on refining CSTM analysis, both site-specific and regional, using map displays. The system will be further integrated with the IDC parame-

ter-based processing, and the peaks on the threshold traces will be analyzed with an automatic event explanation facility based on the IDC bulletin. In cases when the CSTM results suggest that further off-line analysis should be invoked, the IDC Analyst Review Station will be used. In support of the IDC subscription service, we will explore various means to provide data to requesting parties, including AutoDRM and use of the WWW map facility.

In our view, the deployment of advanced small-aperture arrays and the associated development and implementation of automated and increasingly powerful data processing techniques represent major advances in seismic monitoring in recent years. We have demonstrated the potential of improved event definitions at the IDC by refining the phase arrival times and taking regional calibration data into account. Additional research along these lines and subsequent implementation into the IDC of appropriate procedures is needed in order to fully exploit the potential of the array network data, and will be an important focus of our future research.

F. Ringdal
T. Kværna
S. Mykkeltveit

Global Threshold Monitoring — Method Development

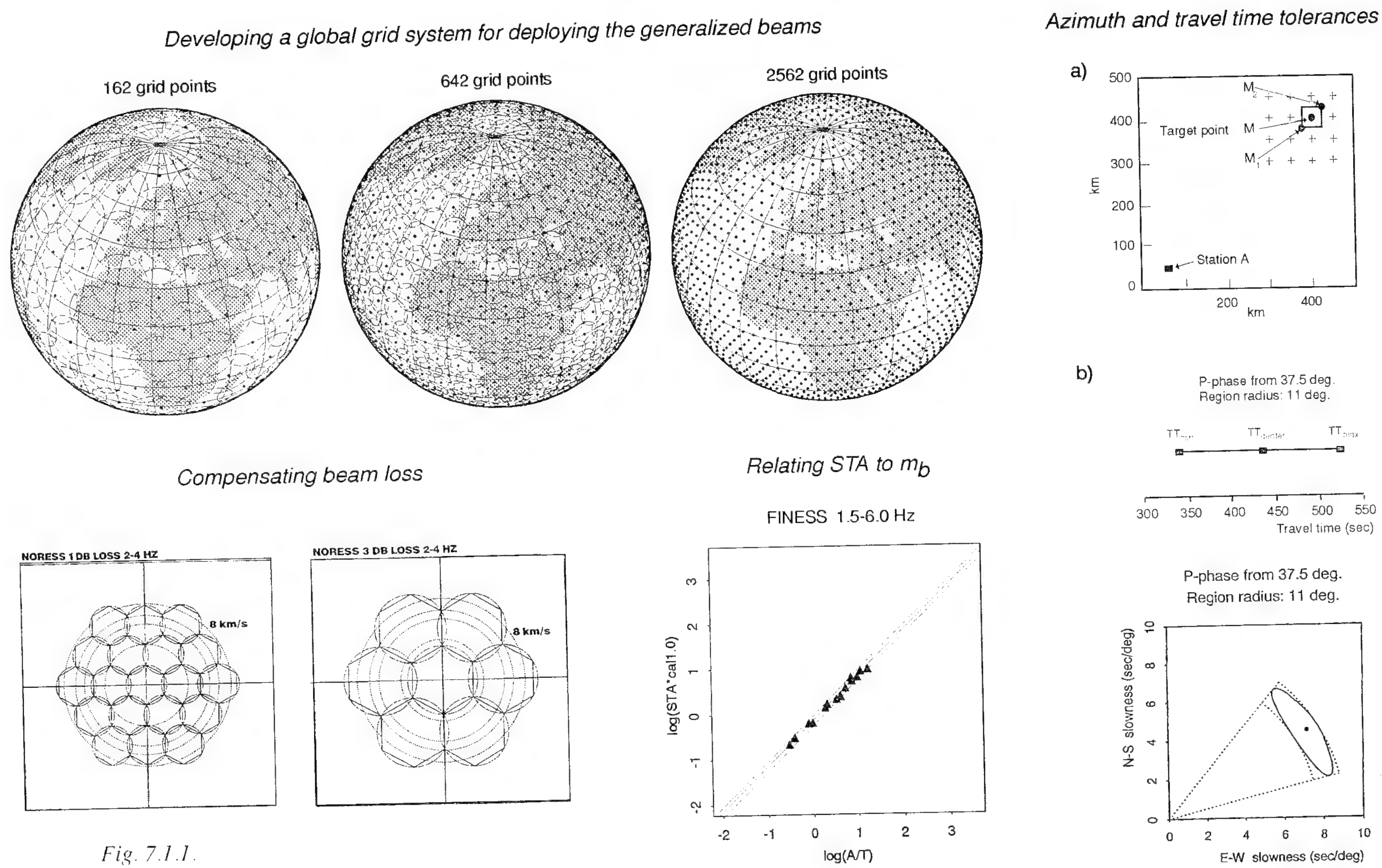


Fig. 7.1.1.

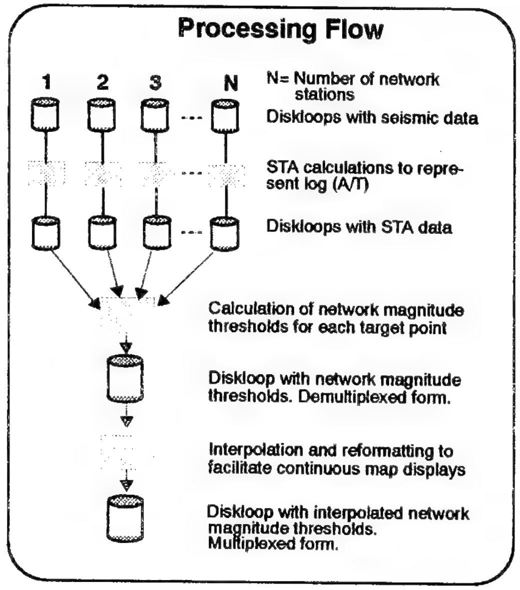
Global Threshold Monitoring — IDC Implementation

Initial IDC implementation

- Continuous Threshold Monitoring map
- 642 or 2562 grid points
- 10 seconds update rate
- 7-day diskloop of STA values
- Regional map displays available
- Site-specific traces extracted on request

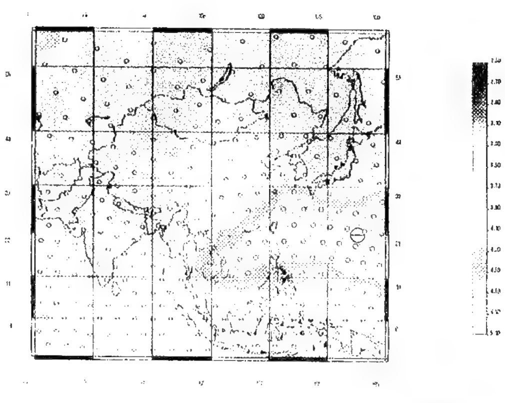
Comments:

- Site-specific traces will be interpolated from the global map
- "Optimum" site-specific traces may be available in the future

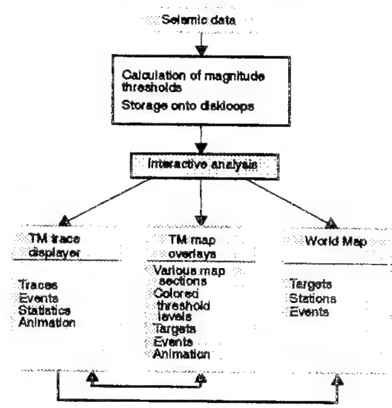


CSTM services provided by the IDC

- World threshold map (e.g., postscript file) at a given point in time
- Site-specific trace (taken from world map) for specified target and time period
- Either data points or trace plot provided
- Specification of IDC events associated with peaks on the trace plot
- Use of CenterView, Data Request Manager, or other mechanisms



Interactive Analysis



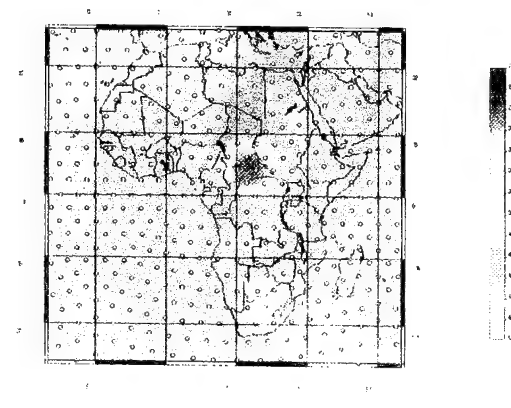
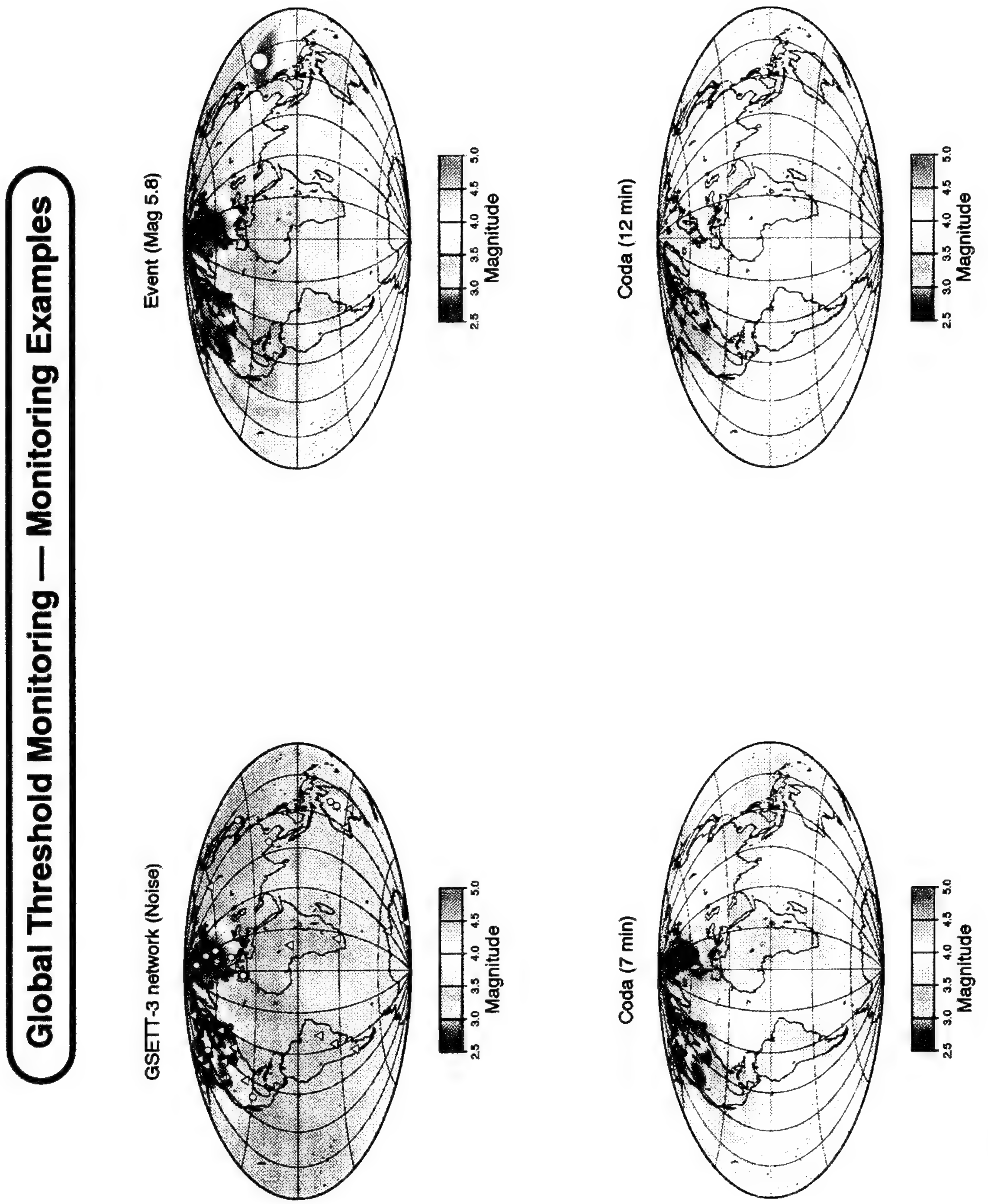


Fig. 7.1.2.

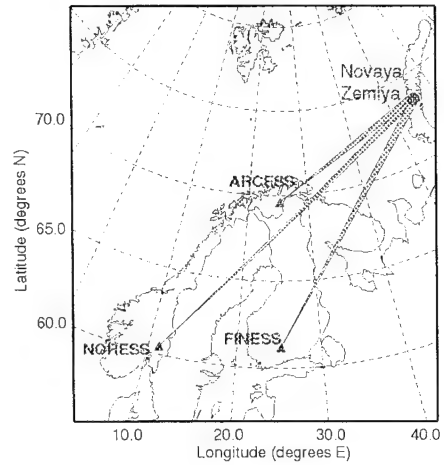


Global Threshold Monitoring — Monitoring Examples
GSETT-3 network (Noise)
Event (Mag 5.8)
Coda (7 min)
Coda (12 min)
2.5 3.0 3.5 4.0 4.5 5.0
Magnitude

Fig. 7.1.3.

Site-Specific Threshold Monitoring

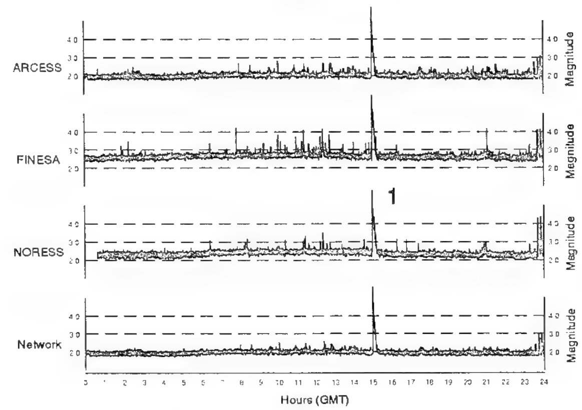
Focusing the network



Principles:

- Focus each array on a target site
  - Optimum beams
  - Optimum filter bands
- Apply probabilistic model to obtain estimate of upper magnitude level (90% confidence)
- Examine and explain peaks on the network threshold trace
- Special applications possible (e.g., monitoring high frequencies for evidence of possible decoupled explosions)

Monitoring Novaya Zemlya, Russia



(1) Underground nuclear explosion ($m_b = 5.7$)

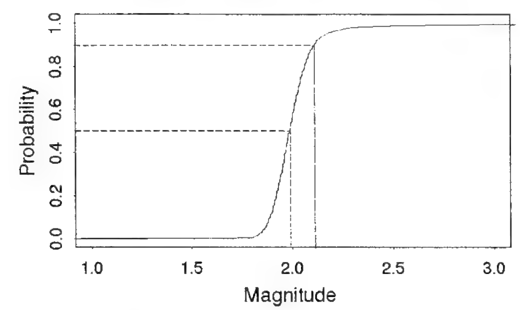
Threshold Monitoring — Novaya Zemlya

Date: October 24, 1990 Day_of_Year: 1990-297

	# Peaks	# Seconds	% of time
Mag>2.50	3	670	0.78
Mag>2.75	2	440	0.53
Mag>3.00	1	325	0.40
Mag>3.50	1	200	0.27

Computing threshold statistics

Threshold magnitudes - Novaya Zemlya



Number of peaks exceeding given magnitude threshold (30 days statistics)

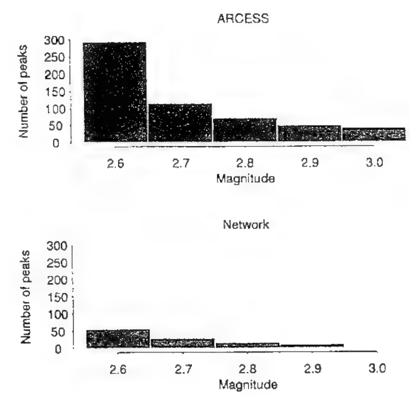
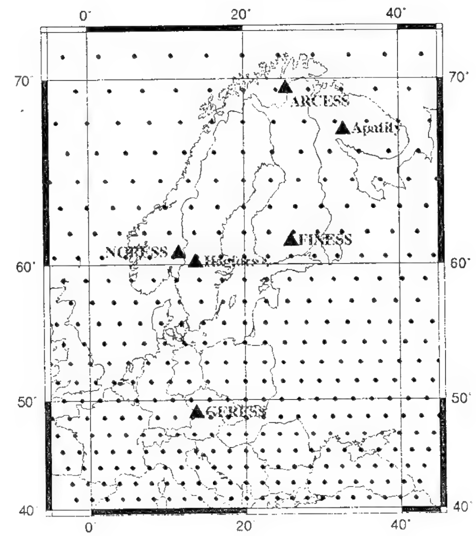


Fig. 7.1.4.

On-line Generalized Beamforming

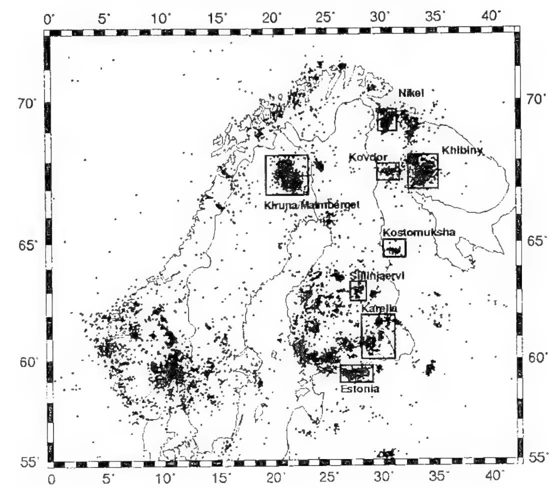
1. Regular operation at NORSAR since 1989
2. Covers Fennoscandia/N. Europe
3. Coarse initial beam grid, supplemented by beampacking
4. Available on-line by finger quake@ugle.norsar.no
5. Location accuracy typically 30 km
6. Automatic post-processing for accurate location under implementation

Initial beam grid



Typical seismicity

Fennoscandia/NW Russia



Internet access:

NORSAR"s Automatic Array Epicenter Solutions

Origin Time				Lat	Lon	Mag	Timres	Azres	N:Tot	Pha	Sta	Sta	Dist	Snr
1995	4	25	5:07:04	66.95	12.09	1.5	0.16	2.95	4	2	1	ARC	624	4
1995	4	25	6:31:23	59.99	22.59	1.2	0.53	1.90	2	2	1	FIN	249	15
1995	4	25	7:31:58	60.09	22.55	1.7	0.77	2.40	4	4	2	FIN	244	13
1995	4	25	7:33:20	63.19	23.76	1.2	0.66	1.45	2	2	1	FIN	229	7
1995	4	25	7:38:35	74.15	35.73	1.7	0.20	11.10	2	2	1	ARC	624	6
1995	4	25	7:59:20	70.85	17.71	1.1	0.33	7.65	3	2	1	ARC	329	11
1995	4	25	8:05:28	60.09	22.55	1.3	0.38	6.70	2	2	1	FIN	244	14
1995	4	25	8:15:45	59.59	10.23	1.2	0.42	3.30	7	4	2	NRS	147	63
1995	4	25	8:39:35	67.85	36.87	1.1	2.73	3.36	4	2	1	APA	166	27
1995	4	25	8:49:05	58.55	27.26	2.0	2.14	3.26	5	3	2	FIN	329	7
1995	4	25	9:05:02	61.99	23.01	1.2	0.48	3.82	2	2	1	FIN	173	40
1995	4	25	9:13:30	68.15	33.40	1.9	2.75	9.40	11	6	2	APA	63	380
1995	4	25	9:24:14	57.95	24.33	2.0	0.96	14.50	3	3	2	HFS	656	19
1995	4	25	9:28:50	58.25	12.48	1.0	3.54	11.98	9	4	2	HFS	221	8
1995	4	25	9:40:37	59.39	27.76	1.9	0.47	5.73	5	3	2	FIN	246	95
1995	4	25	9:55:08	61.19	21.84	1.6	0.50	2.65	2	2	1	FIN	228	9
1995	4	25	10:24:51	59.39	27.17	1.4	0.79	1.27	3	3	1	FIN	236	16
1995	4	25	10:29:51	66.35	12.85	2.4	2.22	6.67	18	10	5	NRS	629	7
1995	4	25	10:30:28	60.09	22.55	1.1	0.19	3.27	2	2	1	FIN	244	10
1995	4	25	11:25:07	67.55	20.39	1.6	1.23	9.08	4	3	2	ARC	304	9
1995	4	25	11:55:26	60.39	21.94	1.4	1.01	4.15	2	2	1	FIN	253	12

******** Last GBF Epicenter Update (GMT): 12.46
Last Update of this file (GMT): Tue Apr 25 13:53
Last Update of this file (local time): Tue Apr 25 15:53

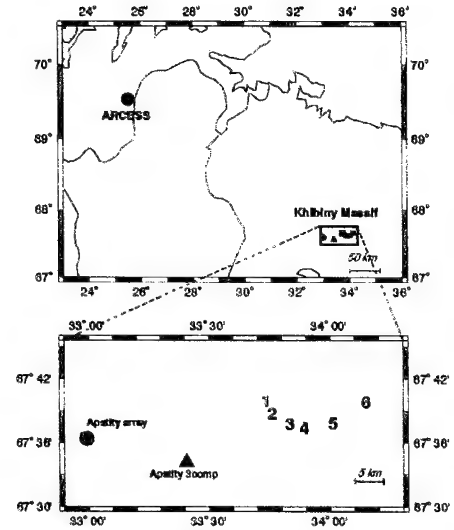
Detailed GBF solutions

Origin time	Lat	Lon	Azres	Timres	Wres	Nphase	Ntot	Nsta	Netmag
1995-115:10.29.51.0	66.35	12.85	6.67	2.22	3.89	10	18	5	2.36

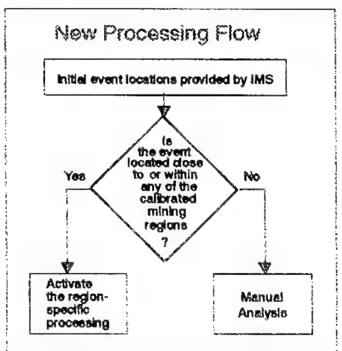
Sta	Dist	Az	Ph	Time	Tres	Azim	Ares	Vel	Snr	Amp	Freq	Fkq	Pol	Arid	Mag
NRS	629.8	5.4	Pn	10.31.16.5	0.7	7.5	2.1	8.1	7.4	346.6	4.52	1		776068	
NRS	629.8	5.4	p	10.31.23.2		7.5	2.1	8.1	3.8	276.2	3.60	2		776072	
NRS	629.8	5.4	Sn	10.32.27.1	4.3	8.2	2.8	4.2	2.7	702.8	4.23	4	3	776074	1.65
NRS	629.8	5.4	Lg	10.32.48.8	1.6	359.9	-5.5	3.7	3.7	1262.6	2.11	2	-2	776081	1.95
NRS	629.8	5.4	s	10.32.55.8		24.4	19.0	4.3	2.8	1865.5	2.84	1		776088	2.15
ARC	637.4	242.2	Pn	10.31.18.4	1.7	232.0	-10.2	9.4	12.2	231.0	4.78	2		776080	
ARC	637.4	242.2	p	10.31.22.1		231.5	-10.7	8.9	3.7	467.1	6.46	1		776083	
ARC	637.4	242.2	p	10.31.27.3		218.2	-24.0	7.9	2.6	389.6	8.43	3		776084	
ARC	637.4	242.2	s	10.32.15.6		231.2	-11.0	5.3	5.1	2021.9	4.76	1	-2	776087	2.06
ARC	637.4	242.2	Sn	10.32.23.1	-1.3	229.4	-12.8	5.2	2.7	1447.7	5.05	2		776089	1.90
ARC	637.4	242.2	s	10.32.41.9		232.2	-10.0	4.1	2.6	1126.2	2.48	1		776090	
ARC	637.4	242.2	Lg	10.32.47.4	-1.9	243.4	1.2	4.3	2.5	1380.9	1.81	1		776092	1.80
HFS	694.4	356.8	Pn	10.31.23.0	-0.6	345.1	-11.7	8.2	5.2	84.7	4.01	3		776069	
HFS	694.4	356.8	Lg	10.33.06.3	1.0	353.7	-3.1	4.0	3.9	272.6	2.04	2		776073	2.28
HFS	694.4	356.8	s	10.33.12.2		352.6	-4.2	3.7	3.2	372.1	2.98	3		776079	2.48
FIN	847.1	315.9	Lg	10.33.45.9	-2.1	321.5	5.6	4.0	4.2	854.3	2.66	1	-2	776095	2.70
APA	887.5	270.3	s	10.33.07.4		279.7	9.4	3.4	4.8	303.8	4.16	3	2	776075	
APA	887.5	270.3	Sn	10.33.10.1	-7.0	258.7	-11.6	4.4	2.8	316.0	4.29	3	2	776082	2.38

Fig. 7.1.5.

Automatic Post-Processing of Khibiny Events



Schematic map of the Khibiny Massif region of the Kola Peninsula of Russia, with its mining sites 1-6.

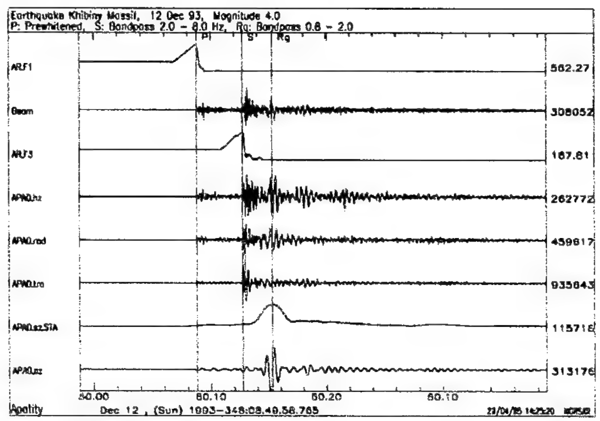


Schematic view of the principle behind the automatic post-processing of seismic events

Fig. 7.1.6.

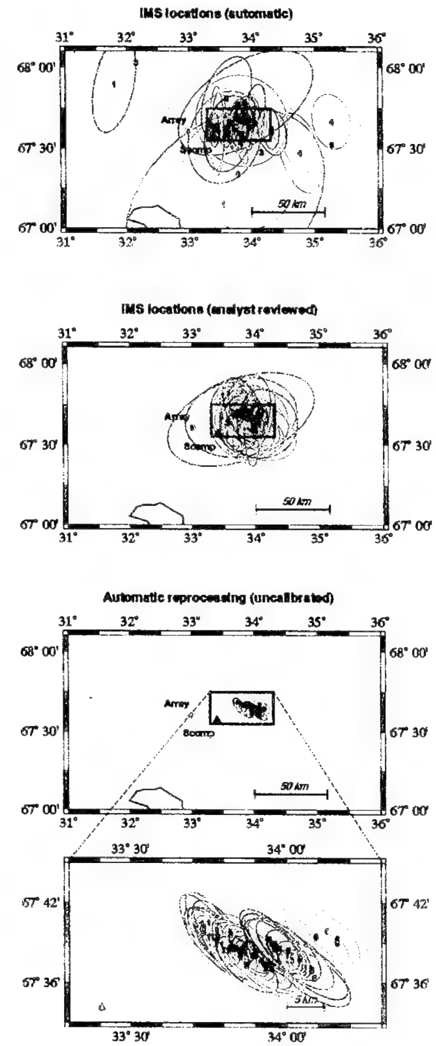
Processing steps:

- P arrival time estimated by autoregressive method
- P azimuth estimated by broad-band f-k method for a fixed frequency band, using a fixed time window positioning
- Find maximum amplitude of Rg-phase
- Rg azimuth estimated by broad-band f-k method for a fixed frequency band, using a fixed time window positioning
- S arrival picking on the three-component instrument using the autoregressive onset time estimator



The seismograms of the figure are Apatity array recordings of an event from mine no. 1. The figure also shows likelihood functions (traces 1 and 3 from the top) used to estimate P and S arrival times, and an STA envelope (trace 2 from bottom) to estimate the peak of the Rg phase.

Improved Location Estimates



7.2 Mapping of azimuth anomalies from array observations

Introduction

This research is a continuation of the work reported by J. Schweitzer (1994) in NORSAR Scientific Report No. 1-94/95 entitled "Mislocation vectors for small aperture arrays - a first step towards calibrating GSETT-3 stations". For details on the database used, and on the method used for association of the observed onsets with theoretically estimated onsets, we refer to the work mentioned above.

Whereas the mislocation vectors derived in the study of Schweitzer (1994) are suitable for use in standard event location programs, a somewhat different mapping of the mislocation vectors is more convenient when grid search based methods are used in processing of seismic network data. Examples of such methods are the Generalized Beamforming (GBF) method for automatic phase association (Ringdal and Kværna, 1989) and genetic algorithms for event location (Sambridge and Gallagher, 1992). These methods scan a geographical grid system of possible event hypocenters, and it is therefore also convenient to store information on corrections to the theoretically predicted slowness vectors in a set of geographical grid cells.

Results

As shown in Fig. 7.2.1, we divided the area covering Europe, North Africa, and adjacent seas into a quasi uniform grid system where the distance between the grid nodes was approximately 1 degree. Due to the non-uniformity of the grid system, we assigned an event located closer to a grid node than 0.8 degrees to that grid node.

In this report we present the derived azimuth corrections for P-phases observed at the small-aperture arrays NORESS, FINESS, ARCESS and GERESS. To reduce the scatter in the correction estimates, a minimum number of 3 hits per node were required. The resulting database also contains azimuth corrections for other types of phases like Pg, Sn, and Sg, as well as ray parameter corrections relative to the IASP91 earth model. Statistics for the Apatity and the Spitsbergen arrays are also available, but these arrays have been in operation for a relatively short time period such that the event database is rather small with limited geographical coverage.

Figs. 7.2.2-7.2.5 show the azimuth corrections for the area under investigation for the 4 arrays. Fig.7.2.6 shows a more detailed picture for the GERESS array. The figures are quite self-explanatory, and it is clear that P-phases from events located within certain regions exhibit significant and consistent azimuth anomalies as observed on the different arrays. Accompanying the figures with azimuth corrections, we also provide a figure showing the number of observations contributing to estimating the azimuth corrections of each grid node, which again reflect the pattern of man-made and natural seismicity. Azimuth corrections and number of events exceeding the numbers given by the color scales are represented by the corresponding scale extremals.

Conclusions

During several years of operation of the European small-aperture arrays, automatically estimated azimuth and slowness values have been obtained for the detected phases. From this material, we have compiled azimuth and slowness corrections for a 1x1 degree grid covering Europe, North Africa, and adjacent seas for each of these arrays. To evaluate the usefulness of such corrections, we plan to incorporate the corrections into the current GBF phase association module now running at NORSAR.

Concerning the phenomena contributing to the observed anomalies, it has been shown by Kværna and Doornbos (1991) that structural inhomogeneities like Moho topography near the receiving arrays can significantly perturb the incoming wavefront. All phases with the same azimuth and apparent velocity should thus have the same azimuthal bias. But the azimuth anomalies often exhibit relatively strong variations over limited geographical areas (see Figs. 7.2.2-7.2.5). Local Moho inhomogeneities thus cannot explain all observed azimuth residuals, so the observed pattern of azimuth anomalies must also be the results of lateral heterogeneities along the whole ray path. For example, the pronounced change in the azimuth residual at GERESS for events from the far south-east (see Fig. 7.2.6) from positive (Greece, Balkan) to negative (Italy) is mostly parallel to the boundary between the Adriatic and the European plate. These residuals will also be influenced by the Moho syncline forming the root of the Alps.

Johannes Schweitzer, Ruhr-University Bochum, Germany
Tormod Kværna, NORSAR

References

Kværna, T. and D. J. Doornbos (1991). Scattering of regional Pn by Moho topography, *Geophys. Res. Letters*, 18, 1273-1276.

Ringdal, F. and T. Kværna (1989). A multi-channel processing approach to real time network detection, phase association and threshold monitoring, *Bull Seism. Soc. Am.*, 79, 1927-1940.

Sambridge, M.S. and Gallagher, K.L., (1992). Earthquake hypocentre location using genetic algorithms, *Bull. Seism. Soc. Am.*, 83, 1467-1491.

Schweitzer, J, (1994). Mislocation vectors for small aperture arrays - a first step towards calibrating GSETT-3 stations, Semiannual Tech. Summary, 1 April - 30 September 1994, NORSAR Sci. Rep. No. 1-94/95, Kjeller, Norway.

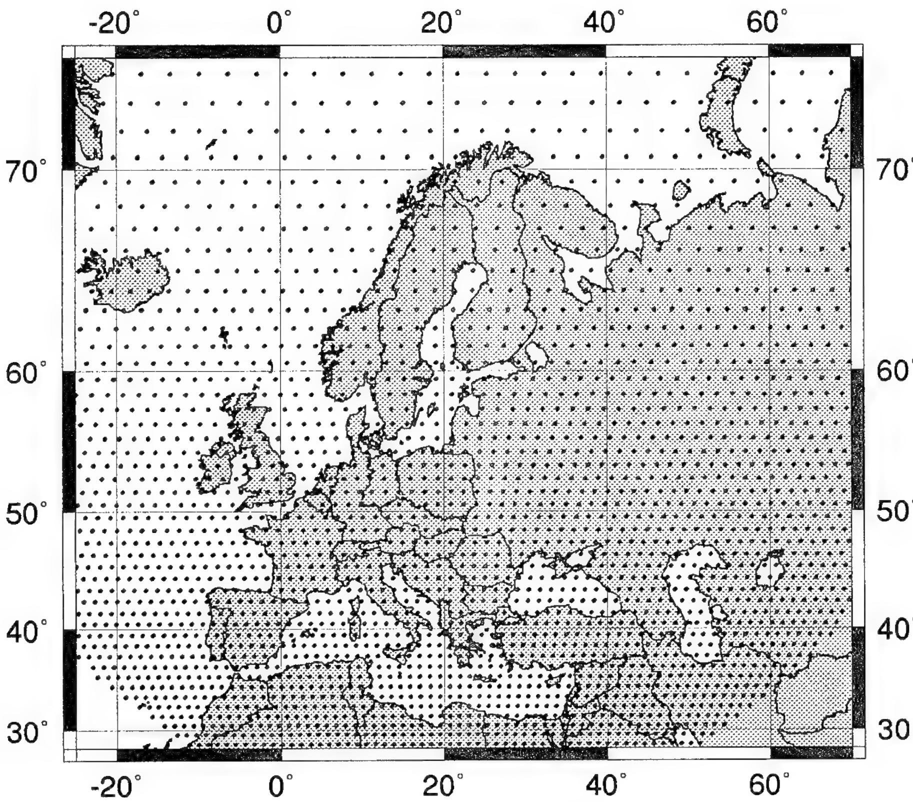


Figure 7.2.1: Map showing the grid system used for mapping of azimuth residuals. The distance between the grid nodes is approximately 1 degree.

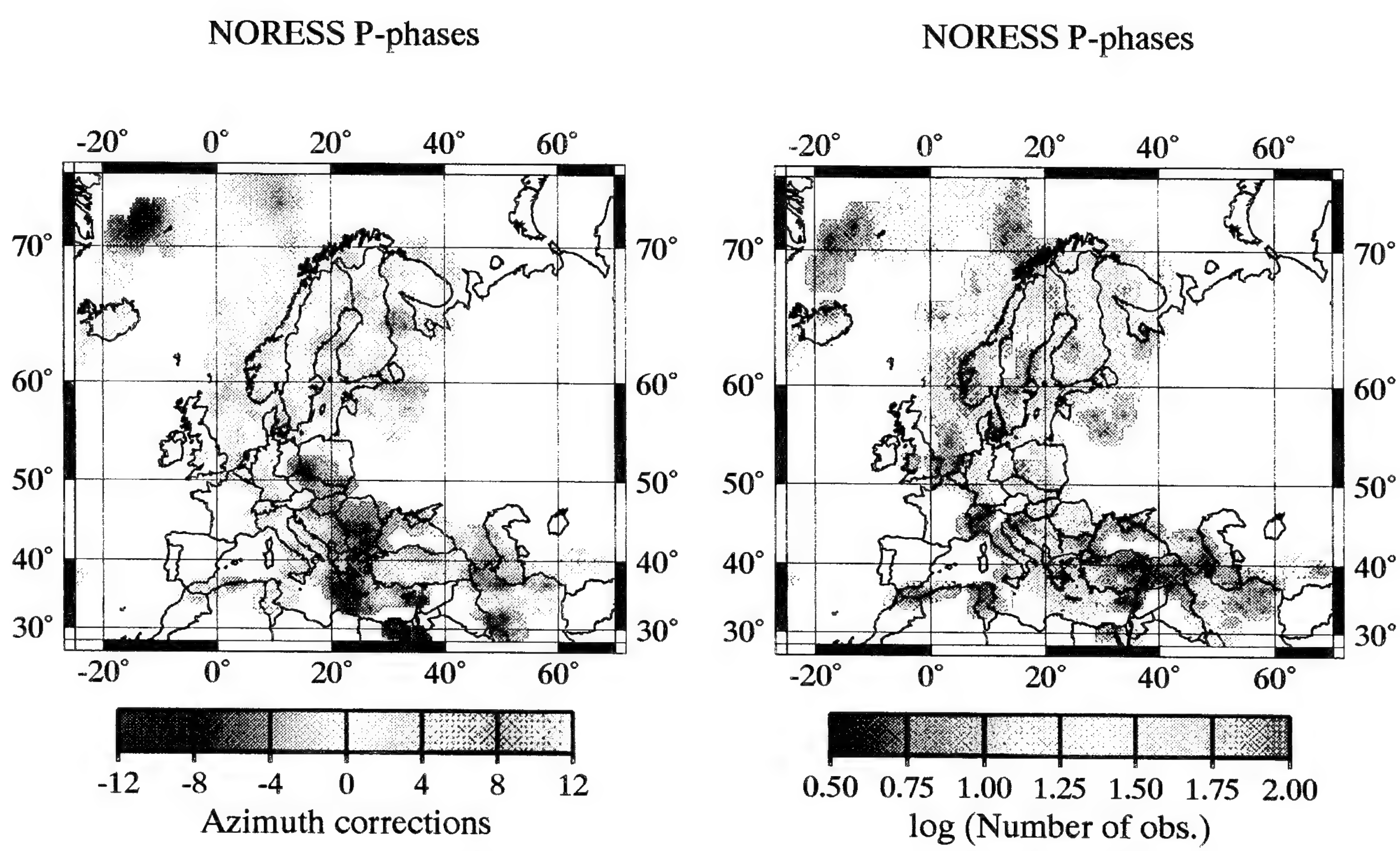


Figure 7.2.2: The left part of the figure shows the estimated azimuth corrections for P-phases arriving at the NORESS array. The right part of the figure shows the number of observations contributing to estimating the azimuth corrections of each grid node. Note that the scale is logarithmic. Azimuth corrections and number of events exceeding the numbers given by the color scales are represented as the scale extremals.

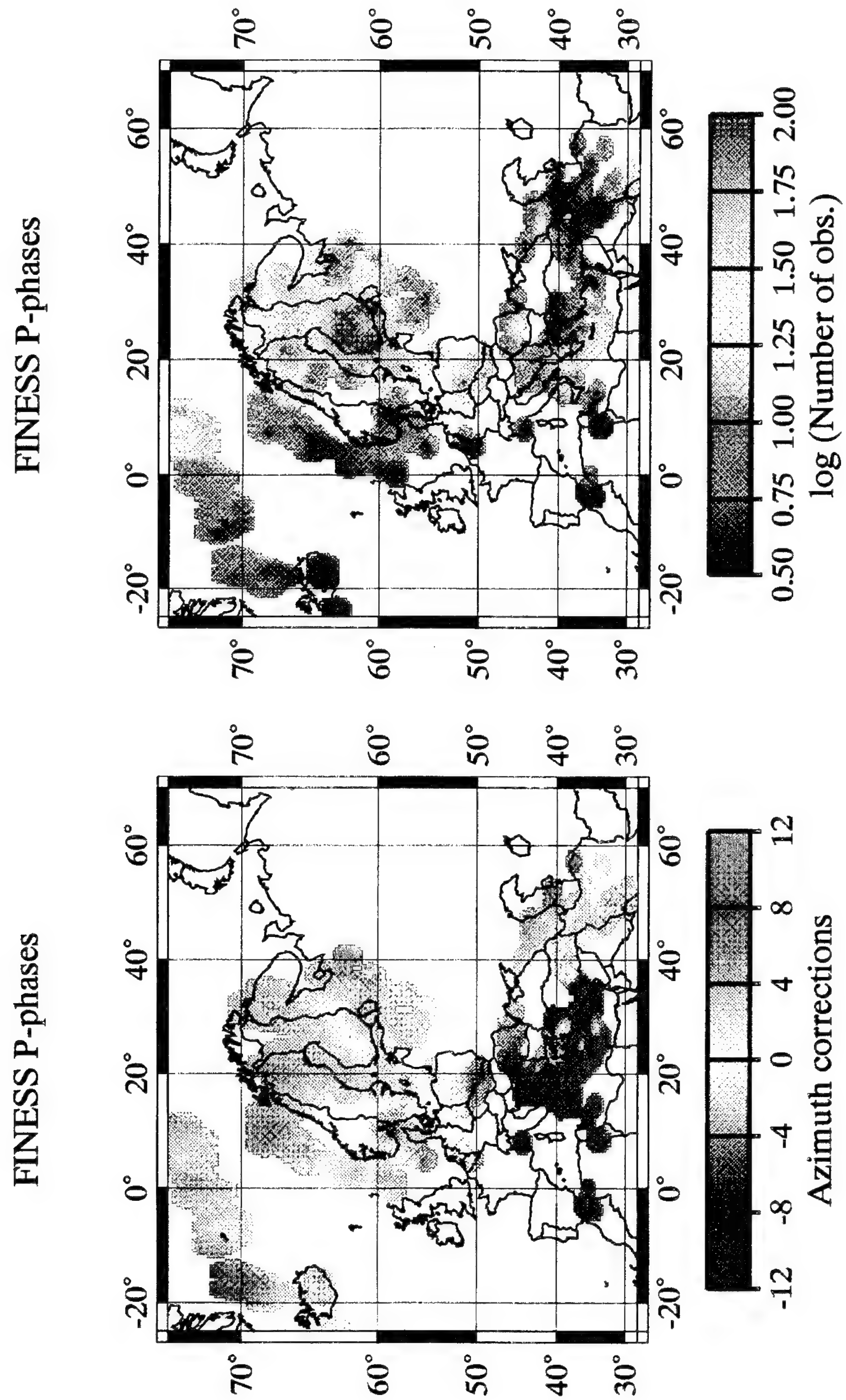


Fig. 7.2.3: Same as Fig. 7.2.2, but for the FINESS array.

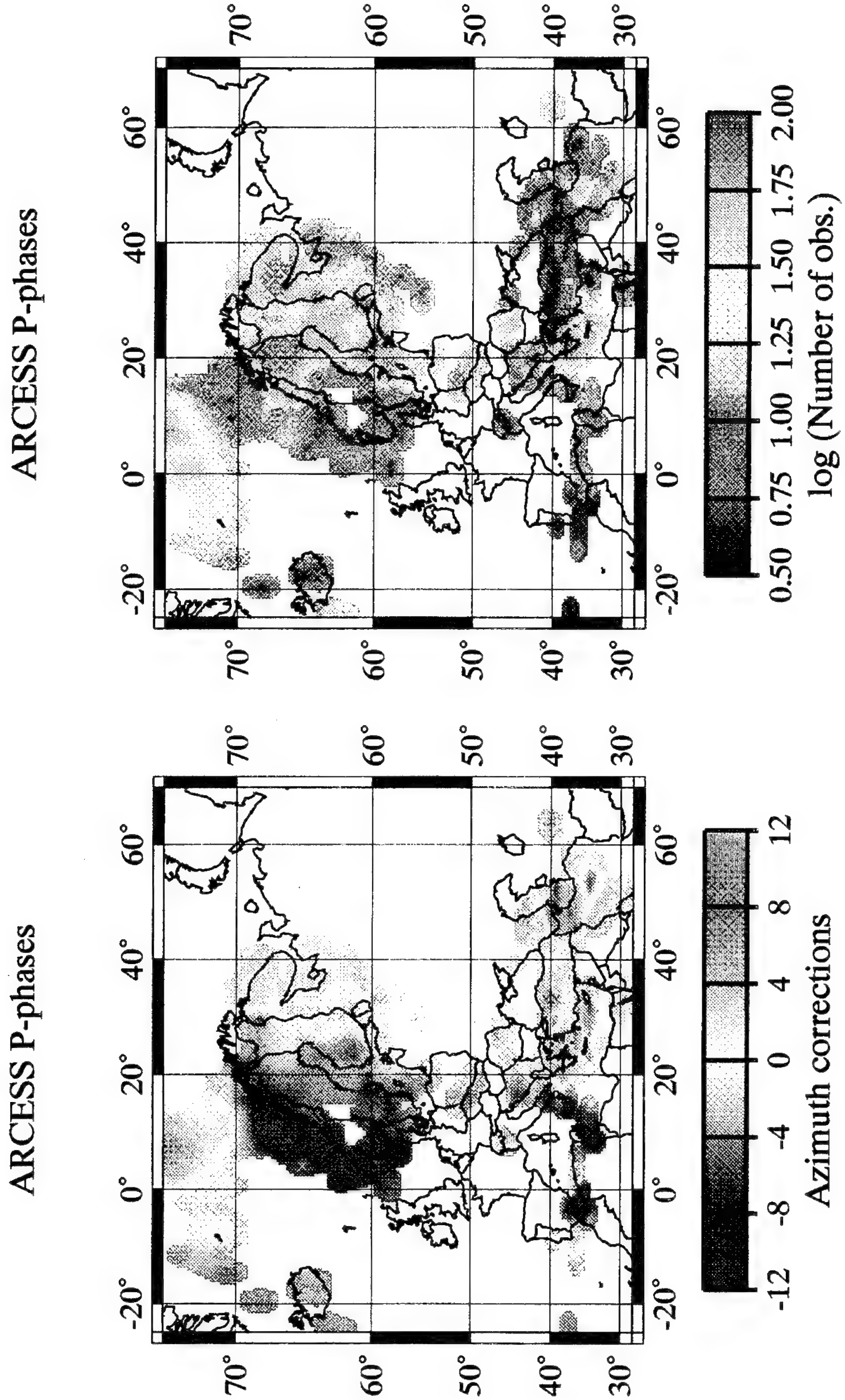


Fig. 7.2.4: Same as Fig. 7.2.2, but for the ARCESS array.

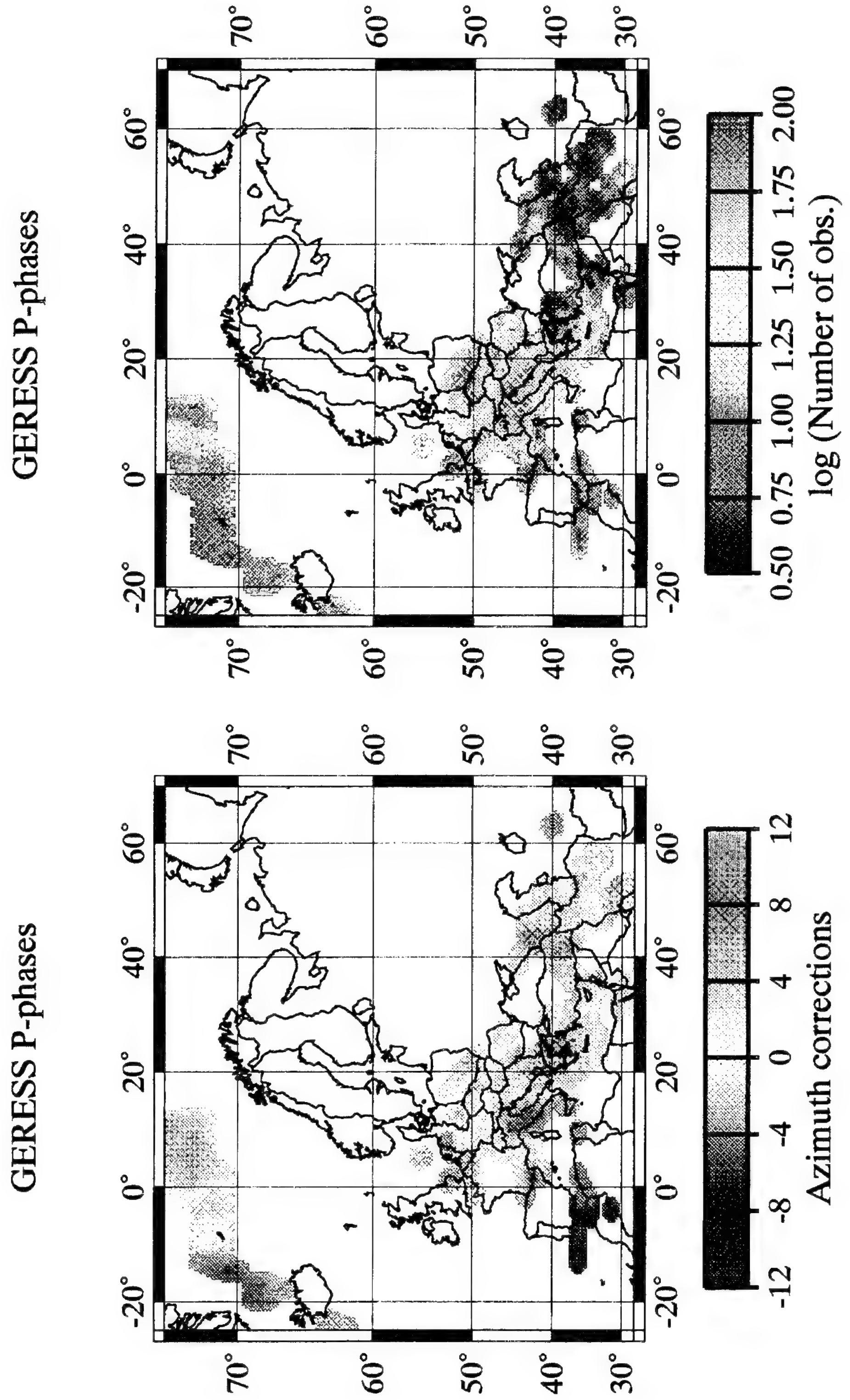


Fig. 7.2.5: Same as Fig. 7.2.2, but for the GERESS array.

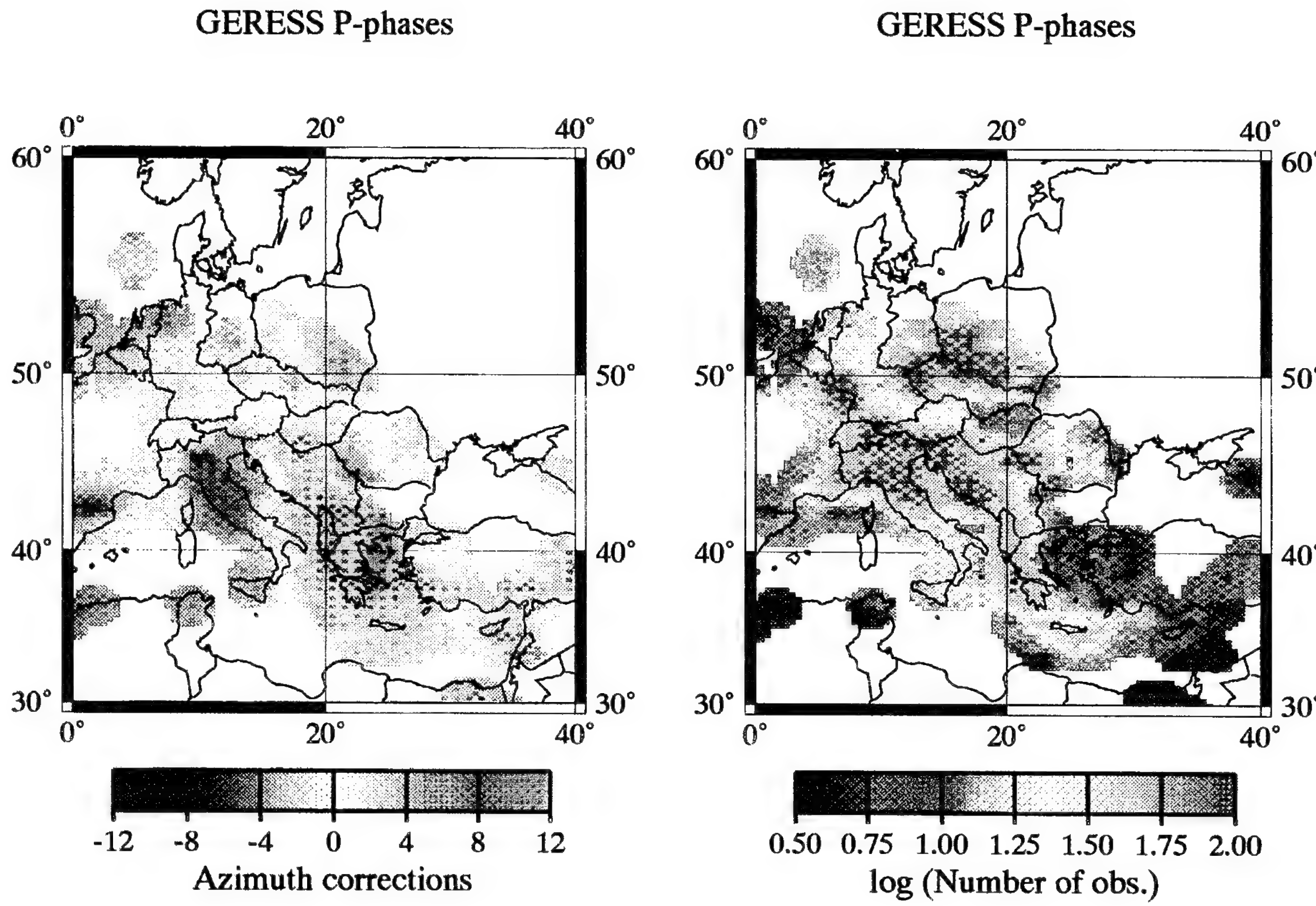


Fig. 7.2.6: Same as Fig. 7.2.6, but with more details of the regions surrounding the GERESS array.

7.3 NORSAR large array processing and time delay measurements

Introduction

The large aperture NORSAR array began operation in 1970, and comprised initially a configuration of 22 subarrays distributed over a diameter of 100 km. After six years of experimental operation, the array was modified on 1 October 1976 to a reduced configuration which was more suitable for an automated, operational system, and the 7 best subarrays (in the NE part of the original array) were selected for this purpose. This configuration is still in operation today, with each subarray comprising 6 SP and one 3-component BB seismometer over an area 8 km in diameter. The total aperture of NORSAR is now 60 km (Fig. 7.3.1). This array configuration enables excellent teleseismic detectability and location capability as illustrated in Fig. 7.3.2.

A complete technical refurbishment of the NORSAR array was carried out during 1992-94, and the array will this year be ready for participation in the GSETT-3 experiment. However, in order to take full advantage of the NORSAR capabilities, it is desirable to update the beam deployment and revise the time delay anomalies taking into account the improved precision made possible from the increased sampling rate (40 Hz against previously 20 Hz) and the accumulated data base of reference events. This paper gives a progress report on the work carried out until now.

Procedure

The main points of revising the NORSAR beam deployment are summarized as follows:

Data base development

We will compile a data base of several hundred well-recorded and well-located events, dating back to the initial NORSAR establishment in 1970. Emphasis will be on obtaining a good geographical distribution of epicenters. Among the events of special interest here will of course be the known nuclear explosions, especially the large number of PNEs in the former Soviet Union.

Reference locations

We will primarily make use of ISC or PDE location estimates for reference purposes. In cases where more accurate locations have been published (e.g., in recent literature or in local bulletins), these locations will be used. Additionally, location of recent events calculated by the GSETT-3 IDC will be a helpful supplement.

Channel correlation

The reference events are systematically analyzed using a semi-automated channel correlation procedure, and verified by an experienced analyst. The correlation is based on the first cycle(s) of the P-signal, in an optimum filter band. A resampling procedure is applied before the correlation in order to improve the timing resolution.

Consistency checking of the delay anomalies

By using several reference events from nearby locations, it will be possible to make a systematic search for outliers, and otherwise ensure that the data are consistent to the extent possible.

Interpolation in inverse velocity space

As originally done by IBM in the LASA/NORSAR development, the data base of time delay anomalies will, if necessary, be subjected to two-dimensional interpolation in inverse velocity space, to obtain anomaly estimates for regions in which no events have been recorded. For many regions, we expect the coverage to be dense enough so that interpolation is unnecessary.

Beam deployment

A revised beam deployment for NORSAR will be developed on the basis of the results of this study. The beamforming gain at various frequencies will be compared to the previous beams, so as to quantify the improvements achieved by this project.

Use of single-sensor anomalies

In contrast to the original time delay anomalies for NORSAR, which were developed only for subarray beams, the new set of delays will be compiled on an individual seismometer basis. This implies that even detection at the subarray level should be significantly improved, especially at high frequencies.

For further details on NORSAR detection processing, slowness estimation and measurement of time delay anomalies, reference is made to Fyen (1995).

Interactive tool for picking arrival times

To create a data base with time delays, it is necessary to measure arrival times at every single site of the current NORSAR array for each reference event.

Knowing hypocenter parameters for the event, we can predict arrival times and slowness for the actual phase, using the IASPEI91 travel time tables.

In practice, the analyst should carefully define and pick the arrival time at a reference site, e.g. NB2_sz. Let this time be A_{ref}. Then arrival times A_i of all other sites will be measured using an interactive program developed for this purpose. This interactive tool is illustrated in Figs. 7.3.3 and 7.3.4.

Initial analysis

We describe in the following results from analyzing six events from the Philippine islands, using the interactive analysis tool. Table 7.3.1 shows a list of the events with parameters from different agencies.

In order to explain Table 7.3.1, let us recall that the NORSAR DP/EP automatic processing consist of three steps. First, Detection Processing - DP, which normally gives one or more detections for the same phase. The next step is beampacking for each detection to refine the slowness estimate and give location for each detection. The third step is grouping of the detections to declare one event and report an automatic event bulletin. Thereafter the analyst can interactively refine the solution, by adjusting onset time, slowness estimate, amplitude or period. Alternatively, the analyst can accept the automatic solution. Table 7.3.1 lists solutions for one or more of the processing steps with a comment field describing the associated processing steps. Here, the comment "C057" refers to the automatic first trigger solution for coherent beam C057, meaning that this beam is the first detection if there are more than one detection for that event. The comment "analyst" means that this is the analyst-reviewed solution.

After having picked all arrival times, predicted and observed slownesses can be calculated. To obtain the "observed" slowness, we use the measured time delays (relative arrival times) and perform a least squares fit of a plane wave to these observations. For comparison, the automatic beampacking results are also shown.

An important observation is the consistency in time delays. Tables 3.3 and 3.4 show the measured time delays for single sensors within subarray 04C and for each subarray beam respectively for the six events. All delays represents corrections to the theoretical arrival times where 01A00 (NAO) is normalized to zero.

In the above experiment, the theorectical arrival time is computed by plane wave delays for "observed slowness". This is to make the observations compatible with the data from Berteussen (1974). The important feature of the tables is the consistency in time delay corrections, even for events within this region where the signals are rather complex.

Conclusions

As can be seen from Tables 7.3.3 and 7.3.4, the measured time delay anomalies are very consistent even though one of the six events is located 500 km away from the others. This confirms the observations by Berteussen (1974) and also confirms that our correlation procedure performs well. Plans are now to begin analyzing a larger data base and integrate it with Berteussen's data in order to develop the best achievable beam deployment for NORSAR.

We might add that the establishment of systematic time delay anomalies is important for earth structure studies, and the data base will be made available to other researchers for this purpose. Also, the associated amplitude patterns, which will be compiled as part of this project, would be of considerable interest in studies of signal focusing and sources of scattering in magnitude observations, both at teleseismic and regional distances.

J. Fyen

Reeferences

Berteussen, K.-A. (1974): NORSAR location calibrations and time delay corrections, NORSAR Sci. Rep. 2-73/74, Kjeller, Norway.

Fyen. J. (1995): Time delay measurements and NORSAR large array processing, NORSAR Technical Report, June 1995, Kjeller, Norway.

#	Source	Origin time	Lat.	Long.	Depth	mb,ms	Comment
10	USGS	1995-110:08.45.04.100	6.495	126.580	33.0	6.1,6.1	Reviewed
10	IDC	1995-110:08.45.12.4	6.330	126.960	88.6	5.7	N 20
10	nao	1995-110:08.45.25.9	10.918	125.412	33.0	6.1	Analyst
10	nao	1995-110:08.45.39.293	12.038	122.008	33.0	6.0	EPX 213565
10	nao	1995-110:08.46.13.086	17.199	116.385	33.0	5.8	EPX 213570
10	nao	1995-110:08.46.13.7	17.165	116.397	33.0	5.8	C057
20	USGS	1995-111:00.09.55.810	11.977	125.634	33.0	5.9,7.0	Reviewed
20	IDC	1995-111:00.09.56.0	11.980	125.740	18.4	5.6	N 20
20	nao	1995-111:00.09.30.149	8.027	130.944	33.0	6.3	214480,anal
20	nao	1995-111:00.23.03.8	7.918	131.052	33.0	6.7	C057
30	USGS	1995-111:00.34.47.820	12.149	125.641	33.0	6.1,7.3	Reviewed
30	IDC	1995-111:00.34.44.6	12.060	125.520	0.0	5.8	N 17
30	nao	1995-111:00.34.23.0	7.902	129.340	33.0	6.6	Analyst
30	nao	1995-111:00.34.14.866	4.721	129.377	33.0	7.2	214625
30	nao	1995-111:00.47.55.1	17.979	118.007	33.0	6.0	C057
40	USGS	1995-111:00.30.12.840	11.883	125.574	33.0	6.2	Reviewed
40	IDC	1995-111:00.30.10.3	11.920	125.590	0.0	5.5	N 18
40	nao	1995-111:00.30.09.3	10.918	125.412	33.0	6.0	Analyst
40	nao	1995-111:00.30.22.811	12.162	121.918	33.0	6.5	214545
40	nao	1995-111:00.30.21.6	11.957	122.079	33.0	6.5	C057
50	USGS	1995-111:05.17.03.850	12.242	126.279	33.0	5.6,6.8	Reviewed
50	IDC	1995-111:05.16.59.0	12.060	125.720	0.0	5.6	N 16
50	nao	1995-111:05.17.43.0	16.198	115.652	33.0	4.7	215280 anal
50	nao	1995-111:05.17.07.247	13.366	131.432	33.0	5.9	215275
50	nao	1995-111:05.17.54.2	16.284	115.627	33.0	5.2	C057
60	USGS	1995-113:05.08.02.960	12.330	125.455	33.0	5.9,6.5	Reviewed
60	nao	1995-113:05.08.09.636	12.162	121.918	33.0	5.9	218775 anal
60	nao	1995-113:05.08.10.5	11.957	122.079	33.0	5.9	C057

Table 7.3.1. List of events.

#	Fkx	Onset time	v_C	v_O	v_B	ρ_C	ρ_O	ρ_B
10	213565	110:08.58.28.900	24.695	25.199	21.3	64.269	72.919	68.7
20	214480	111:00.22.56.346	24.005	26.064	21.3	62.681	69.193	67.5
30	214625	111:00.47.47.649	23.987	26.638	21.4	62.599	66.544	65.9
40	214545	111:00.43.13.613	24.011	25.432	22.3	62.775	72.599	69.2
50	218275	111:05.30.04.644	24.010	26.153	20.7	61.999	70.526	71.2
60	218775	113:05.21.01.727	23.958	26.133	20.0	62.681	69.783	70.3

Table 7.3.2. Estimated slowness components for different processes. v_C is apparent velocity predicted using IASPEI91 tables. v_O is apparent velocity estimated by plane wave least squares fit to measured time delays. The time delays are measured by using the interactive tool to pick each individual arrival time. v_B is apparent velocity estimated by beampacking process, including old time delay corrections. ρ_C, ρ_O, ρ_B are correspondingly the backazimuth components.

Epx	04C00	04C01	04C02	04C03	04C04	04C05
10	0.553	0.639	0.507	0.474	0.489	0.569
20	0.565	0.625	0.499	0.434	0.484	0.574
30	0.582	0.681	0.554	0.485	0.534	0.627
40	0.573	0.649	0.538	0.457	0.522	0.592
50	0.588	0.647	0.581	0.493	0.531	0.608
60	0.567	0.653	0.520	0.487	0.531	0.582

Table 7.3.3. Example of time delay corrections relative to the theorectical arrivals for sensors within subarray 04C.

Epx	01A_N	01B_N	02B_N	02C_N	03C_N	04C_N
10	0.000	-0.001	0.138	0.150	0.415	0.553
20	0.000	0.024	0.201	0.120	0.384	0.559
30	0.000	-0.001	0.200	0.073	0.366	0.582
40	0.000	0.004	0.167	0.106	0.393	0.573
50	0.000	-0.016	0.185	0.139	0.361	0.540
60	0.000	0.033	0.235	0.098	0.339	0.538

Table 7.3.4. Observed time delay corrections relative to the theoretical arrivals for subarray beams.

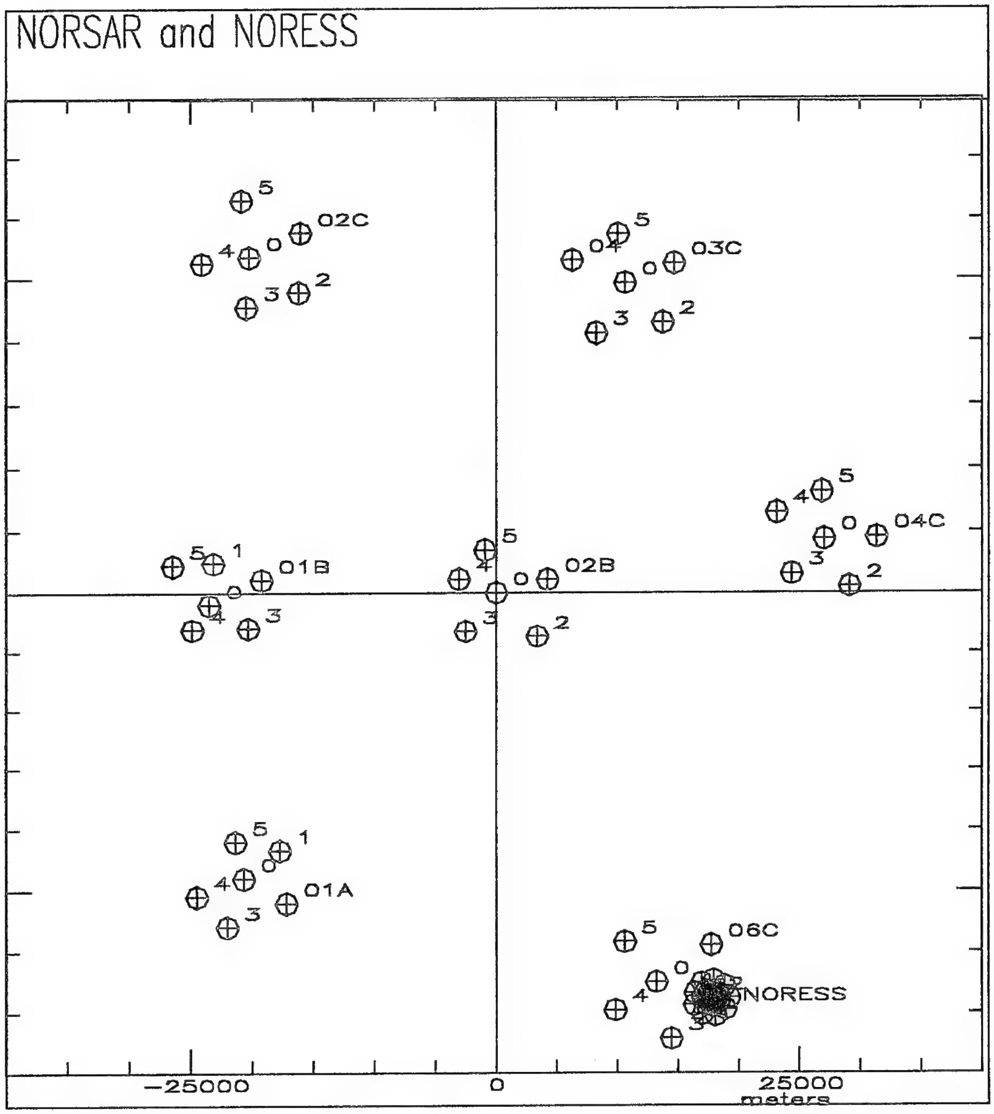


Fig. 7.3.1. Configuration of the large aperture array NORSAR and small aperture array NORESS. The NORESS array is co-located with the NORSAR subarray 06C. The diameter of NORSAR is about 60 km and the diameter of NORESS is about 3 km. Each instrument site is marked with a circle and a cross.

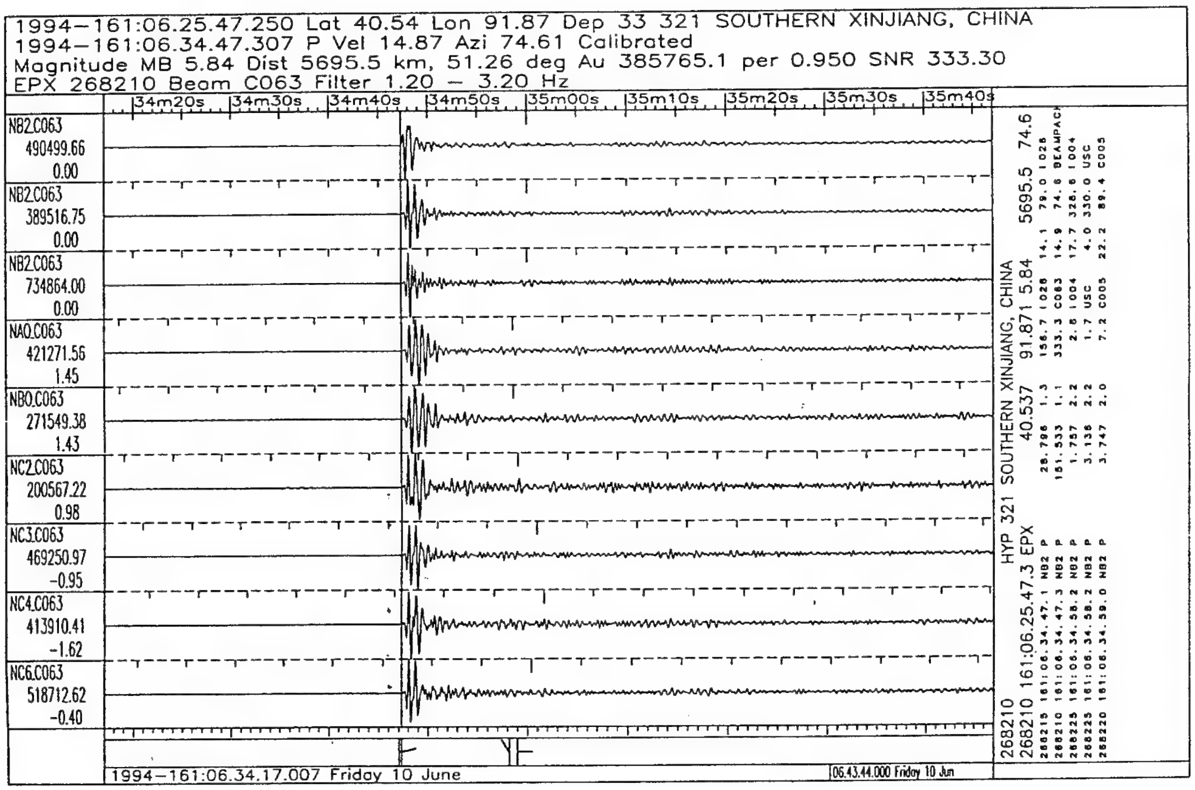


Fig. 7.3.2. Plot of automatic NORSAR detection/event processor output for the Lop Nor nuclear explosion of 10 June 1994.

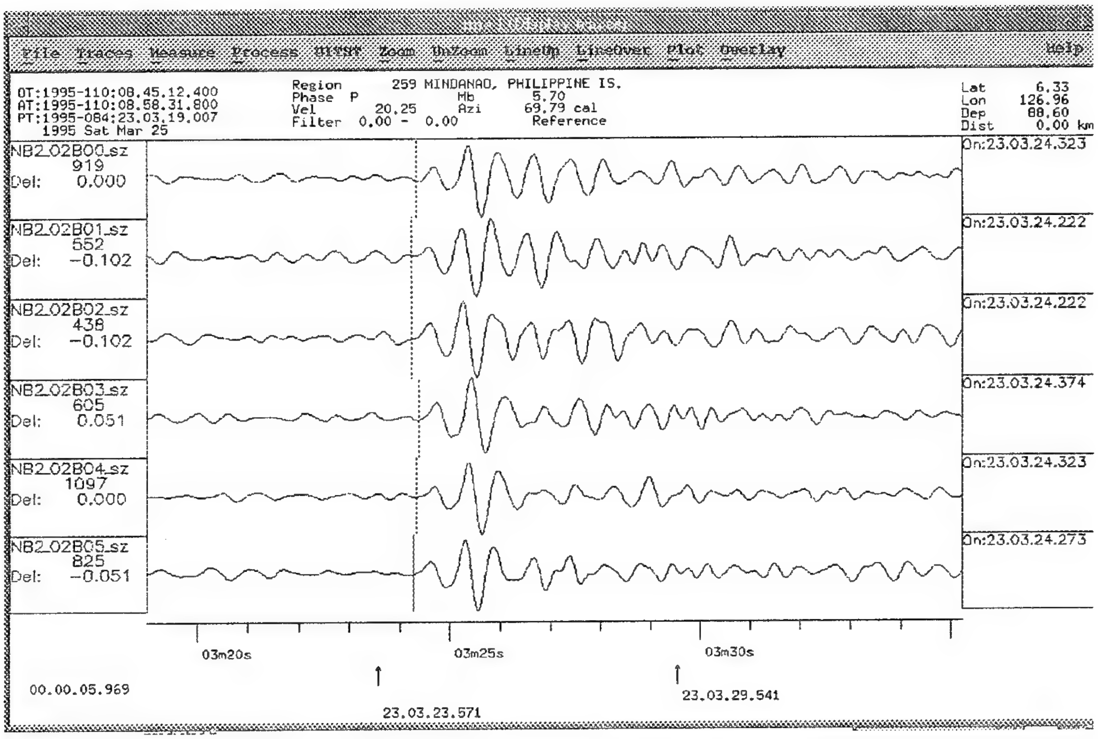


Fig. 7.3.3. NORSAR interactive tool for time picks. A trace-cursor containing the reference trace with reference arrivaltime mark is available to the user, but not visible on this figure. Using this cursor, the analyst can easily correlate the signals to find best arrival time pick.

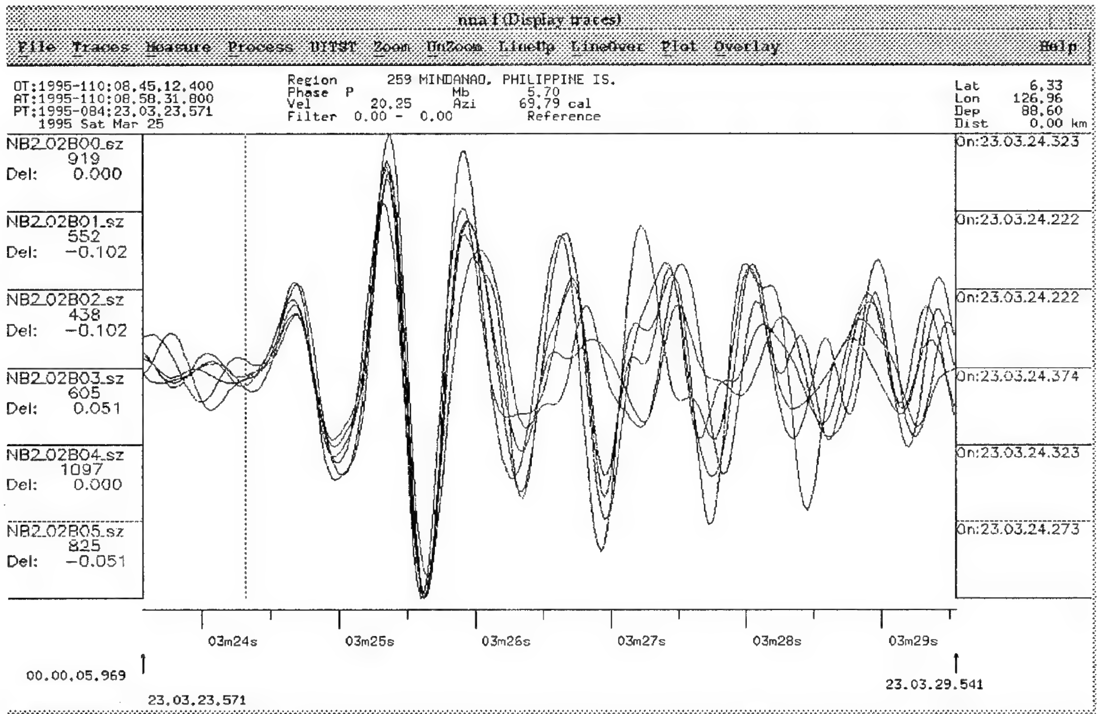


Fig. 7.3.4. Interactive tool for time delay measurements. A line-up of traces with respect to picked arrival time, overlay of the traces, and zooming can be used to check the similarity of the traces, and determine quality of the time picks.

7.4 Magnitude estimation using the IDC Threshold Monitoring system

Introduction

Several recent papers have addressed the shortcomings of the currently available magnitude scales for the purposes of GSETT-3. Harjes (1995) has suggested that a "unified" magnitude scale should be developed for operational use at the IDC. Such a magnitude scale should have the following general characteristics:

- Consistent with current teleseismic m_b
- Applicable to "all" distance ranges
- Computed automatically
- Valid over large magnitude range (at least 2.0-6.5)

The primary purpose would be to develop a 'generic" magnitude scale that could be used as a first estimate of m_b. Subsequent refinements would then be possible by introducing station/region-specific correction factors in areas where adequate data is available.

This paper describes a possible approach to developing a unified magnitude scale, by using the IDC Threshold Monitoring system.

Threshold Monitoring approach

The global Threshold Monitoring (TM) system implemented at the IDC offers a data base that is directly applicable to m_b estimation. As explained in detail in previous publications (see, e.g., Ringdal and Kværna, 1992), the method consists of computing individual station STAs (short term averages) continuously in time for each point in a global grid system. The STA values are thereafter converted to "magnitudes" by using station-dependent calibration factors and applying a standard set of distance corrections. It is noted here that log (STA) and log (A/T) are usually quite consistent, as illustrated in Fig. 7.4.1.

In summary, the TM approach has the following basic features:

- STA data available for all stations
- Use of wide, "generic" filter bands
- Use of generic, global attenuation curves
- Simple extension to maximum-likehood magnitude
- Instrument response adjusted to be flat to velocity (A/T)
- No A/T computed for individual frequencies.

In the following, we give some initial results using the TM method for m_b estimation at the IDC.

Initial results

We have analyzed in detail individual station data of two events reported in the IDC Reviewed Event Bulletin (Table 7.4.1). The analysis has comprised:

- Measuring interactively m_b for all reported P-phases (0-100 degrees)
- Calculating TM m_b values for all available stations
- Comparing the individual m_b values for
    - analyst m_b (interactively measured)
    - IDC reported m_b (computed automatically)
    - TM m_b (computed automatically)

In the TM analysis, a wide band filter (0.8-4.0 Hz) was used for most stations, except for some cases where a more high-frequency filter was found more appropriate. The choice of filter settings is similar to, although not identical with the IDC TM estimates as currently implemented (Kværna et al, 1994).

The results for the three techniques are shown as histograms in Fig. 7.4.2 and 7.4.3, for Events 1 and 2, respectively. It is noted that the analyst-measure m_b and the TM m_b have about the same standard deviation, whereas the IDC m_b values have a couple of outliers that cause the standard deviation to be somewhat larger.

Fig. 7.4.4 shows scatter plots comparing the TM m_b and IDC m_b to the analyst m_b. The IDC station m_b values are mostly very consistent, but again a couple of outliers are noted. This problem is currently being investigated by the IDC, and is expected to be corrected in the near future.

We also attempted to apply a multiple-filter technique to measuring m_b at individual stations. This technique comprises:

- Adjust response to be flat to velocity
- Compute A and T for multiple narrow-band filters
- Select largest log A/T with "detection"
- Compute traditional m_b

Although we did this analysis interactively, the procedure is simple to automate. It has the advantage of being close to the traditional approach for m_b measurement. However, it may be less stable than m_b based on a broad-band filter, such as TM m_b.

Examples of the multiple-filter technique are shown in Fig. 7.4.5. These examples indicate that it may be possible to obtain a consistent automatic m_b measurement, including measurements of amplitude and period, by this method. However, more data must be analyzed to determine its potential.

Future plans

Future work, in this area should comprise:

- Apply TM technique to larger data base
- Investigate multiple-filter technique
- Develop generic global attenuation curves
- Investigate regional corrections
- Apply TM method to M_s measurements, including upper limits.

Besides providing more information on the potential to develop a consistent, "unified" magnitude scale, this research would also contribute to improving and tuning the application of the TM method itself at the IDC.

T. Kværna
F. Ringdal

References

Harjes, H.-P. (1995): Calibrating an IMS at regional distances, *in* Proceedings, CTBT Monitoring Technologies Conference 1995, ARPA, Arlington, VA.

Kværna, T., A system for continuous global seismic threshold monitoring, Semiannual Tech. Summary 1 October 93 - 31 March 94, NORSAR Sci. Rep. 2-93/94, Kjeller, Norway.

Ringdal, F. & T. Kværna (1992): Continuous seismic threshold monitoring, *J. Geophysics Int.*, 111, 505-514.

	Date	Origin Time	Lat	Long	Depth (km)	m_b	N (m_b)	Ndef
Event 1	1995/04/08	17.12.50.9	15.23S	173.46W	0	5.1	14	30
Event 2	1995/04/08	17.45.18.3	21.91S	142.58E	305	5.8	25	52

Table 7.4.1. Event parameters as reported in the IDC REB for the two events discussed in the text.

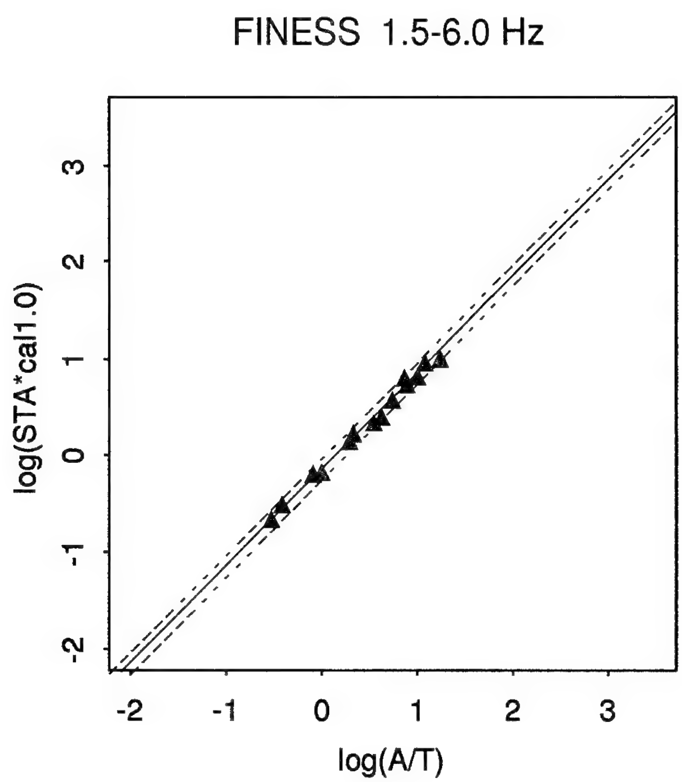


Fig. 7.4.1. Figure illustrating the linear dependency between log (A/T) and log (STA x cal). For the station FINESS and the frequency band 1.5-6.0 Hz, shown on the figure, the best-fitting straight line (with a restricted slope of 1.0) is:

$$\log (STA \times cal) = \log (A/T) - 0.15$$

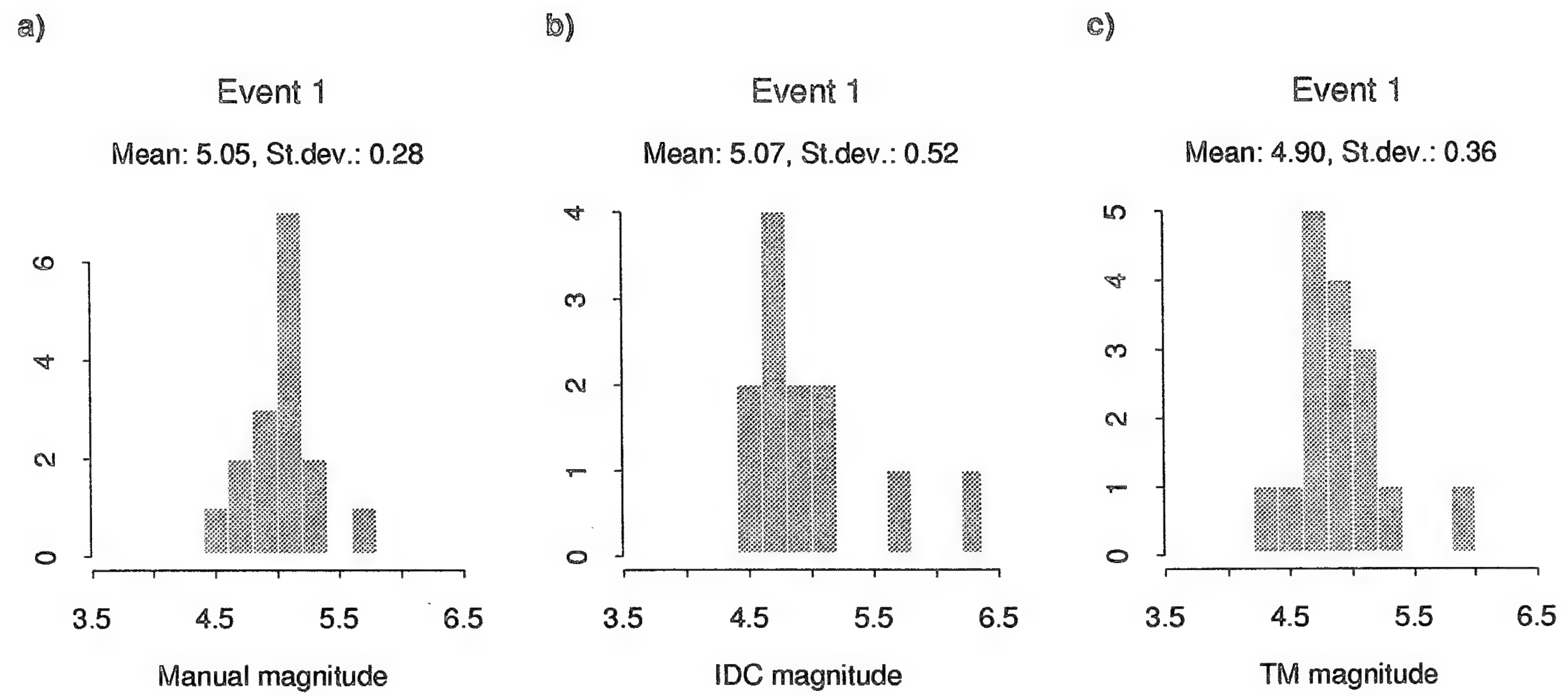


Fig. 7.4.2. Histograms of individual station m_b values mesured for Event 1 by each of the methods: (a) Interactive analyst measurement; (b) Automatically computed station m_b as listed in the IDC REB; and (c) Automatically computed m_b from IDC Threshold Monitoring system.

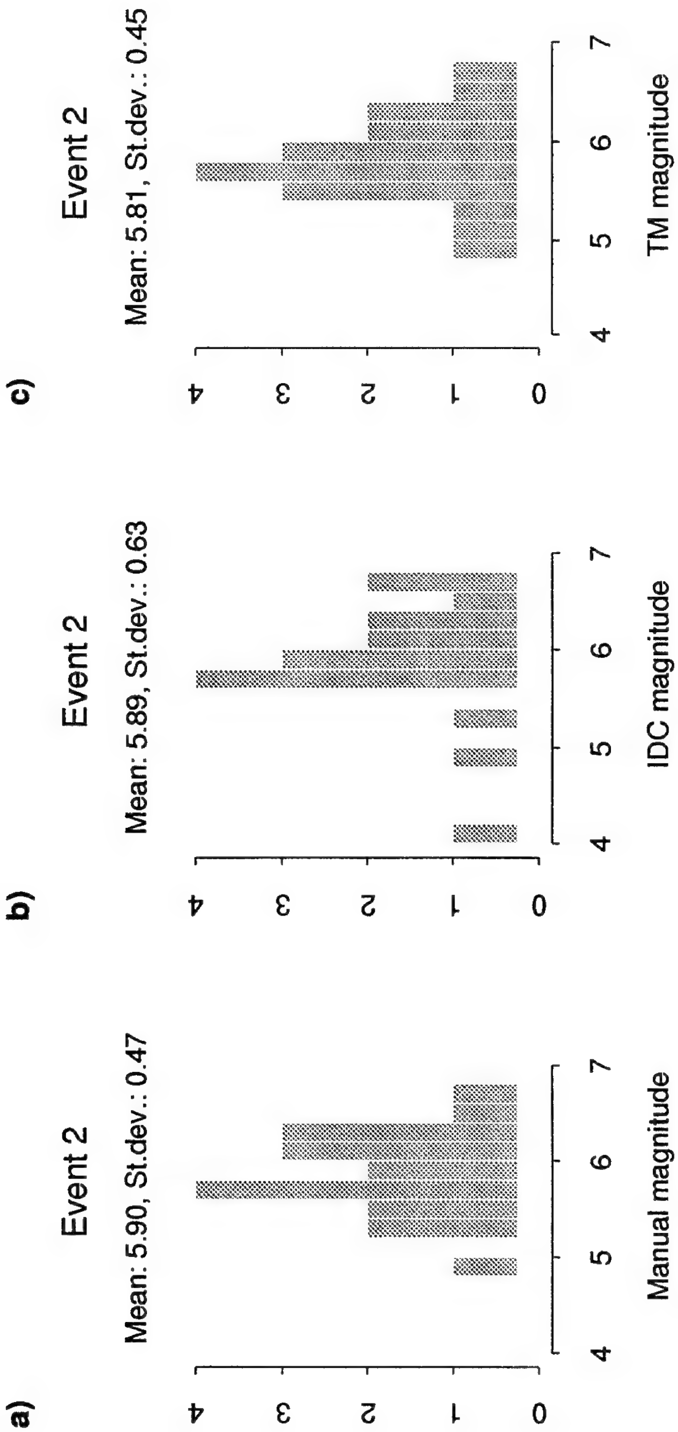


Fig. 7.4.3. Same as Fig. 7.4.2, but for Event 2.

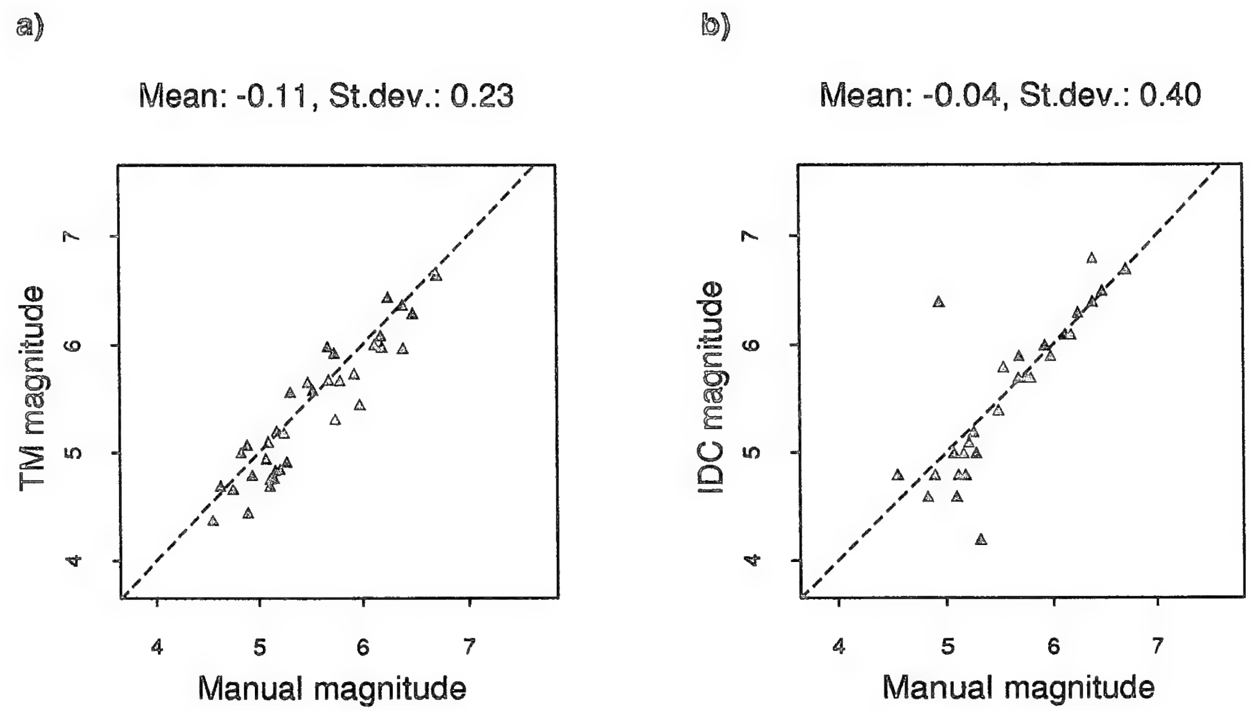
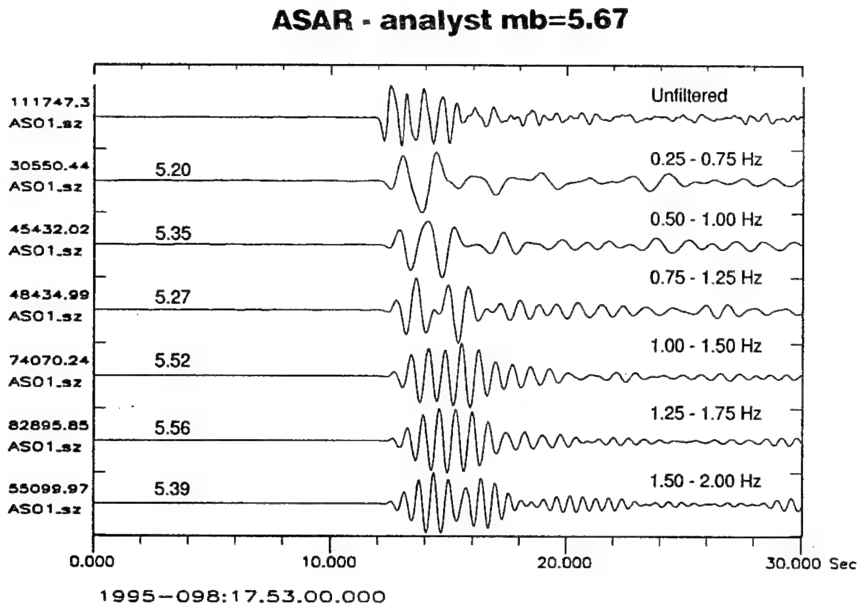


Fig. 7.4.4. Scatter plots comparing (a) TM station magnitudes and (b) IDC station magnitudes to magnitude determined by the analyst. The data in the plots comprise the combined station data for Events 1 and 2.



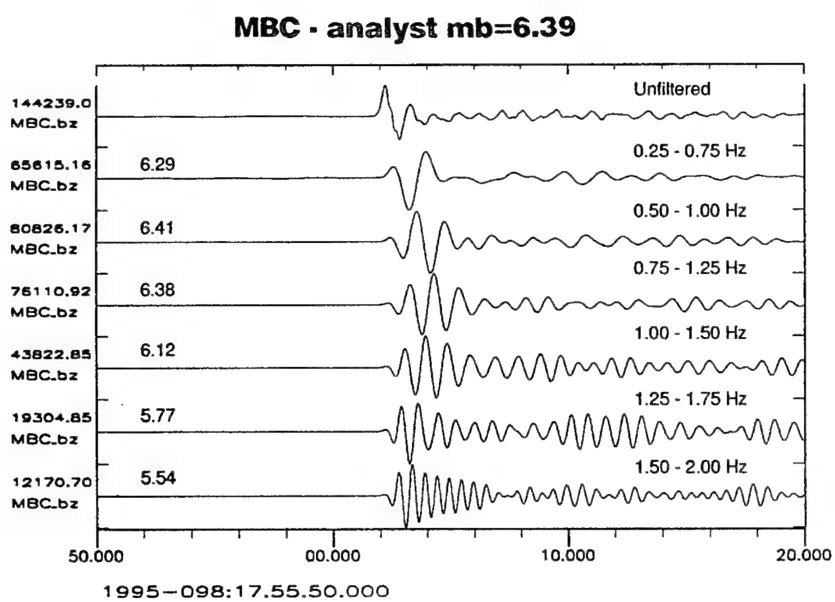


Fig. 7.4.5. Examples illustrating the multiple narrow-band filter technique for measuring m_b. For each plot, the largest m_b value would be selected as representing the station m_b. For station ASAR (top), the max "narrow-band" m_b is 5.56 (compared to analyst m_b of 5.67) and for station MBC (bottom) the corresponding numbers are 6.41 and 6.39. Thus, the correspondence is quite good in these two examples.

7.5 Processing of Spitsbergen array data

Introduction

The Spitsbergen array is used as an Alpha station in the GSETT-3 experiment currently conducted by the Group of Scientific Experts. This nine-element 1 km aperture array is described in Mykkeltveit et al (1992). Since its installation in 1992, the array has undergone a number of incremental upgrades and improvements with respect to field instrumentation, power supply system and various other aspects concerning the reliability and stability of the field system. The most noteworthy modification in the context of this short communication was the replacement in September of 1994 of the nine vertical S-500 seismometers by Guralp ESP seismometers. At the same time, a broadband three-component seismometer of type Guralp CMG-3T was installed at site B4.

Data from the Spitsbergen array are transmitted continuously to the GSETT-3 International Data Center (IDC) in Arlington, Virginia. At the IDC, the Spitsbergen data are subjected to detection processing, and the results are incorporated in the global network processing at the IDC, which results in a daily Reviewed Event Bulletin (REB) issued 2-3 days after each data day.

In the fall of 1994, it was observed that the processing of Spitsbergen array data both at NORSAR (using the dp/ep processing package) and at the IDC (using the SigPro program module) was non-optimal. The main problems appeared to be associated with the following three categories:

- a large number of false, non-seismic detections
- detections associated with events at very short distance
- poor estimates of the slowness vector, with the f-k analysis resulting in teleseismic type velocities for many local phases.

Fig. 7.5.1 illustrates the problems associated with the latter category above. The figure shows the P-wave azimuth residuals as given in REBs issued during January - March 1995, for the Spitsbergen array as well as for the ARCESS and Hagfors arrays. As expected from the aperture difference between the arrays, these residuals are much larger for the Spitsbergen array than for ARCESS (ARCESS has an aperture of 3 km). The Spitsbergen residuals are, however, also much larger than for the Hagfors array. The aperture of the 5-element Hagfors array is the same as that of the Spitsbergen array. It is thus reasonable to assume that by proper tuning of the post-detection processing of the Spitsbergen data, one would be able to better estimate the slowness vector.

This contribution describes our initial efforts towards improving the processing of Spitsbergen array data to make this array contribute better in the global network context.

Processing results for new recipe

A close examination of the Spitsbergen data showed that many of the false detections appeared to be associated with short data dropouts. The special factor to consider here is the relatively broadband character of the data from the Guralp sensors of the array, which appears to require a different quality control algorithm to handle data dropouts than those used for other array data recorded at NORSAR.

Further, the study of the Spitsbergen array processing revealed that the f-k analysis performance to estimate the slowness vector was not optimal. To avoid leakage of low-frequency noise into the passband used in the f-k analysis, it was found that prefiltering the data in a frequency band adapted to the passband of the detecting beam improved the stability of the slowness estimates. It was also found that the f-k spectrum must be computed out to slowness values of 1 s/km to capture phases with low apparent velocity.

More specifically, we tested a new recipe for the dp/ep Spitsbergen processing against the old recipe, where the new recipe was characterized by the following:

1. Improved data quality control in the detector algorithm to account for data dropouts.
2. New algorithm for prefiltering the data before applying the f-k analysis: If a detection is declared on a beam filtered in the frequency band f_1 - f_2 Hz, then prefilter the data in the passband (f_1 - 0.5) - (f_2 + 0.5) Hz using a 3rd order Butterworth filter with two passes.
3. Extension of the slowness search space out to 1 s/km to accommodate phases with low apparent velocity.

For 27 March 1995 we made a comparison between the output from the old and new recipes for the Spitsbergen array, with results as shown in Tables 7.5.1 and 7.5.2. The improved data quality control reduced the number of detections from 1116 to 966. The tables show the f-k results in terms of phase velocities and f-k quality, respectively. It is seen that the new recipe has greatly reduced the number of detections with assigned high phase velocities. Similarly, the percentage of detections with phase velocities below 2 km/s has increased significantly. The f-k quality (which is a measure of the height of the main peak in the f-k spectrum relative to the second highest peak, and where a value of 1 indicates the most well-defined peak) distribution centers on higher values for the new recipe, which is to be expected since the f-k analysis is generally performed on data prefiltered in a higher band for the new recipe.

Changes in the IDC processing of Spitsbergen data

Based on the above results from the new Spitsbergen processing recipe, recommendations were made to the IDC to make similar changes in SigPro. We have been made aware that the DFX code that will soon replace SigPro has new procedures for improved data quality control, so the revised gap handling in the new NORSAR dp/ep recipe was not part of the recommended changes. Changes in SigPro implemented on 2 June 1995 thus amounted to the following:

- Prefiltering of the data before f-k analysis. The SigPro code can only accommodate two filter bands for this, and it was decided to use the bands 1.5-12.0 Hz and 2.0-12.0 Hz for signals with dominant frequencies below 2 Hz, and equal to or above 2.0 Hz, respectively.
- Extension of the slowness search space out to 1 s/km.

In order to assess the effects of the modifications made to the processing of Spitsbergen data at the IDC on 2 June 1995, SigPro results before and after this date were compared to the results from the new recipe running at NORSAR (since 28 March). Fig. 7.5.2 shows the phase velocities for the Spitsbergen detections at the IDC (top) and at NORSAR (bottom), for a time interval before the change was made in SigPro, and Fig. 7.5.3 provides the same comparison for a time interval following this change. It is evident that the changes made in SigPro have not had the desired effects; there is still a predominance of very high phase velocities. It is noted that the distribution of phase velocities in the NORSAR dp/ep Spitsbergen processing is very similar to that observed for the other arrays, like, e.g., ARCESS.

Similarly, the f-k quality was compared for time intervals before and after the changes in SigPro. As can be seen from Figs. 7.5.4 and 7.5.5, there is a shift in the direction of higher f-k quality values, as expected.

Fig. 7.5.6 shows the P-wave azimuth residuals in the REB for Spitsbergen for a time interval after the changes in SigPro. Even though the number of phases used is fairly limited, it can be seen when comparing with Fig. 7.5.1 that the azimuth residuals have not changed significantly.

Conclusions

We have succeeded in developing some clear improvements in off-line processing of Spitsbergen data, but so far it has not been possible to duplicate these results at the IDC. Our conclusion is that the choices for prefilters before the IDC f-k analysis are too limited, but we also understand that this situation will be rectified with the introduction in the IDC processing of the new DFX code.

Fig. 7.5.7. shows the dominant signal frequencies for the REB Spitsbergen P-wave arrivals for distances exceeding 20 degrees for the period after the SigPro changes (the SigPro changes did not affect these values). It is seen that about 50% of the teleseismic P-wave signals have dominant frequencies of 3 Hz and above, and these signals should consistently have been filtered before f-k with a filter that has a lower cutoff higher than 2 Hz.

The work towards improving the Spitsbergen array processing will thus continue.

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Reference

Mykkeltveit, S., A. Dahle, J. Fyen, T. Kværna, P.W. Larsen, R. Paulsen, F. Ringdal and I. Kuzmin (1992): Extensions of the Northern Europe Regional Array Network — New small-aperture arrays at Apatity, Russia, and on the Arctic island of Spitsbergen. In: Semiannual Tech. Summ. 1 April - 30 September 1992, NORSAR Sci. Rep. No. 1-92/93, Kjeller, Norway.

Velocity interval v km/s	Old recipe No. of detections	New recipe No. of detections
v≤2	7	278
2<v≤3	35	47
3<v≤4	23	149
4<v≤6	43	168
6<v≤8	40	126
8<v≤10	57	79
10<v≤12	42	60
12<v≤14	30	31
14<v≤20	77	22
20<v	762	6
All	1116	966

Table 7.5.1. The table shows the phase velocities for Spitsbergen array detections for 27 March 1995 as determined by the old and new NORSAR dp/ep recipes, respectively.

f-k quality	Old recipe No. of detections	New recipe No. of detections
1	545	20
2	85	34
3	435	766
4	51	4
All	1116	966

Table 7.5.2. The table shows the f-k quality for Spitsbergen array detections for 27 March 1995 as determined by the old and new NORSAR dp/ep recipes, respectively.

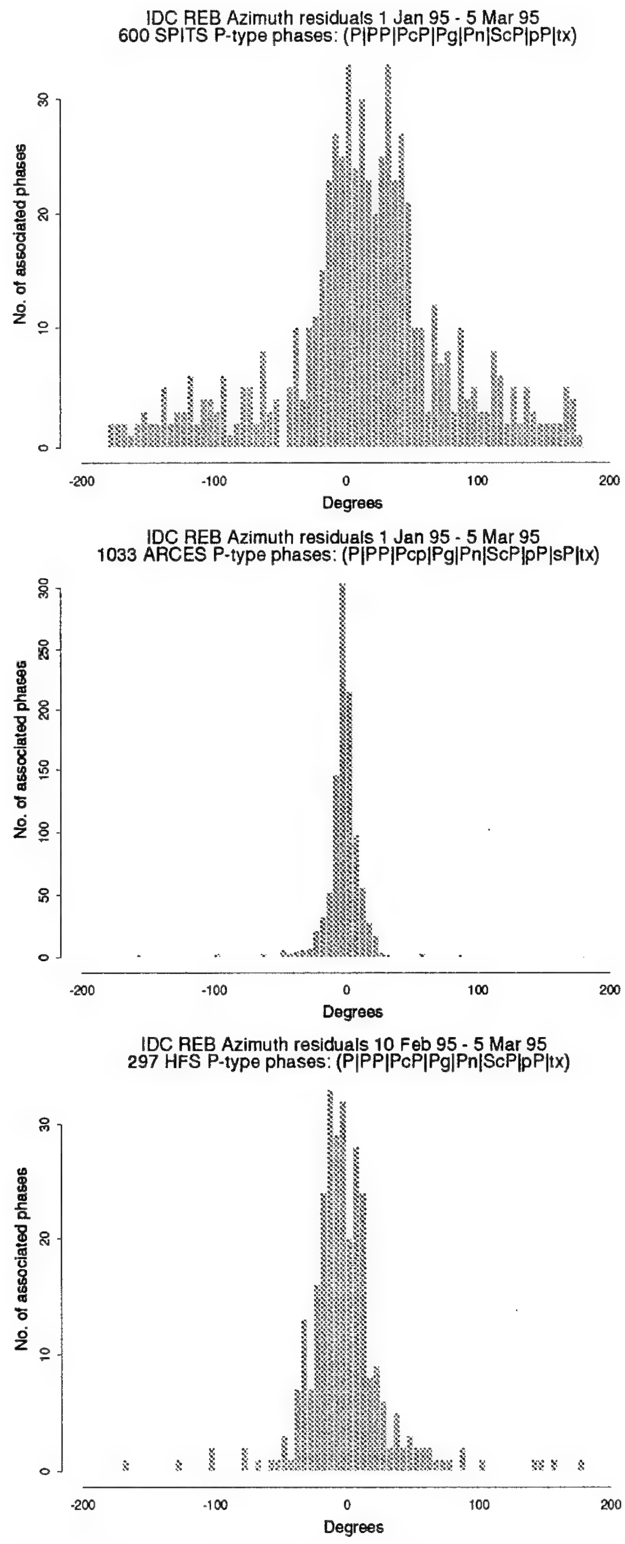
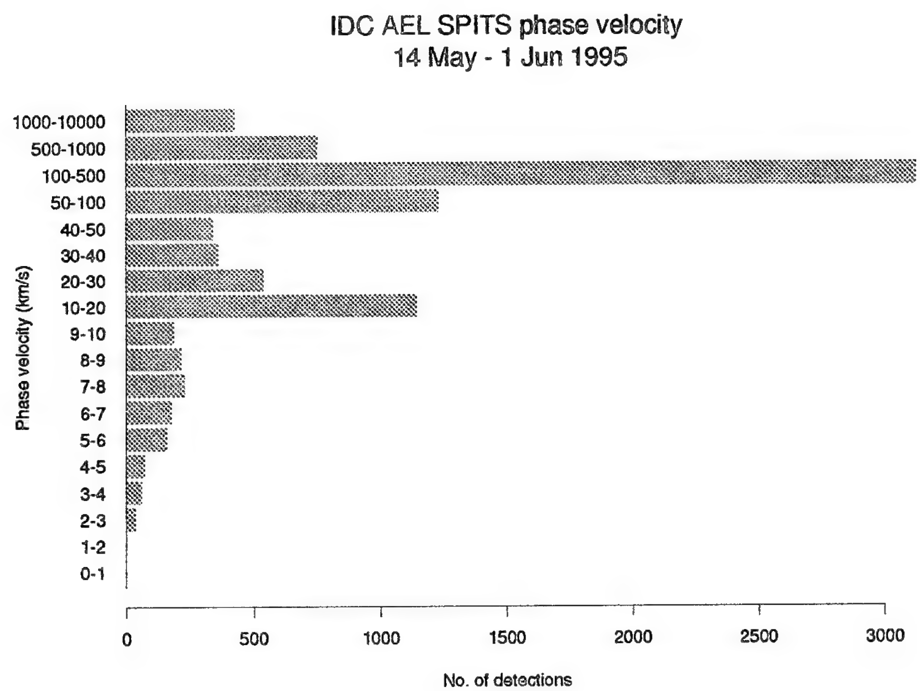


Fig. 7.5.1. P-wave REB azimuth residuals for the Spitsbergen array (top), the ARCESS array (middle) and the Hagfors array (bottom) for the time intervals indicated for each station.



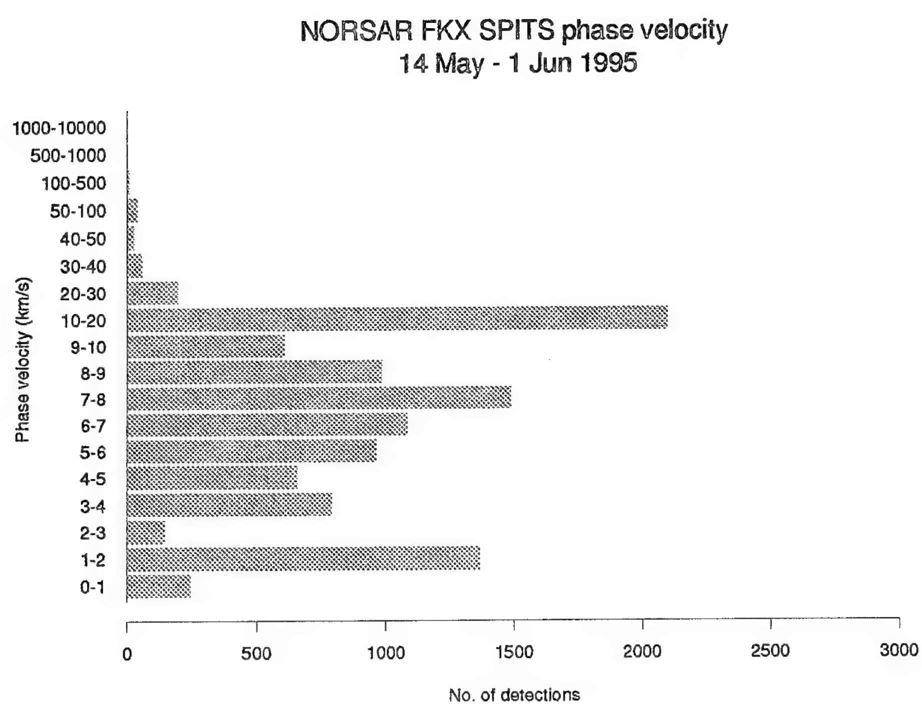
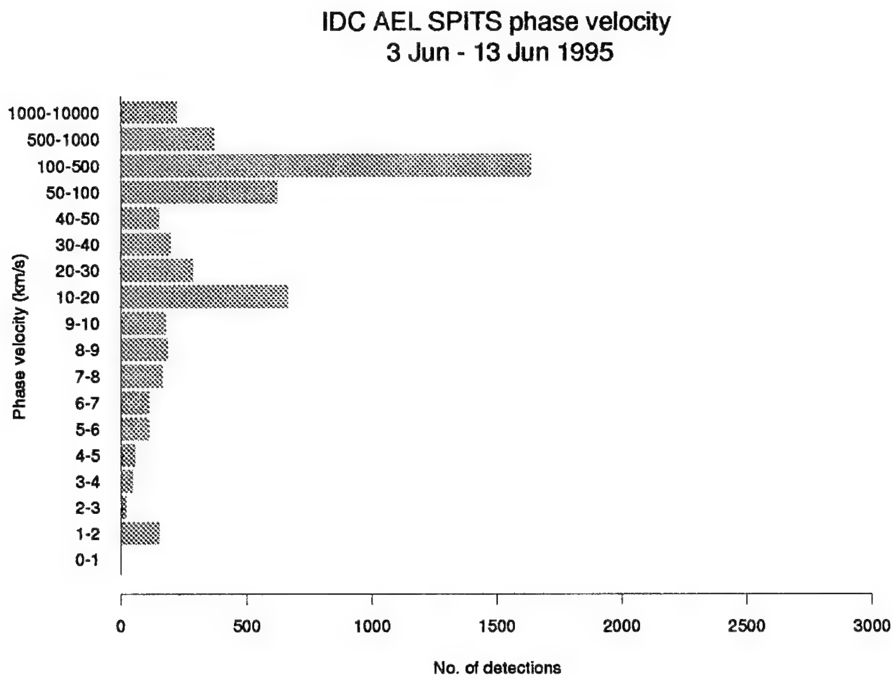


Fig. 7.5.2. Phase velocities for Spitsbergen array detections by SigPro at the IDC (top) and by the dp/ep package at NORSAR (bottom) for a time interval before the modification to the SigPro processing.



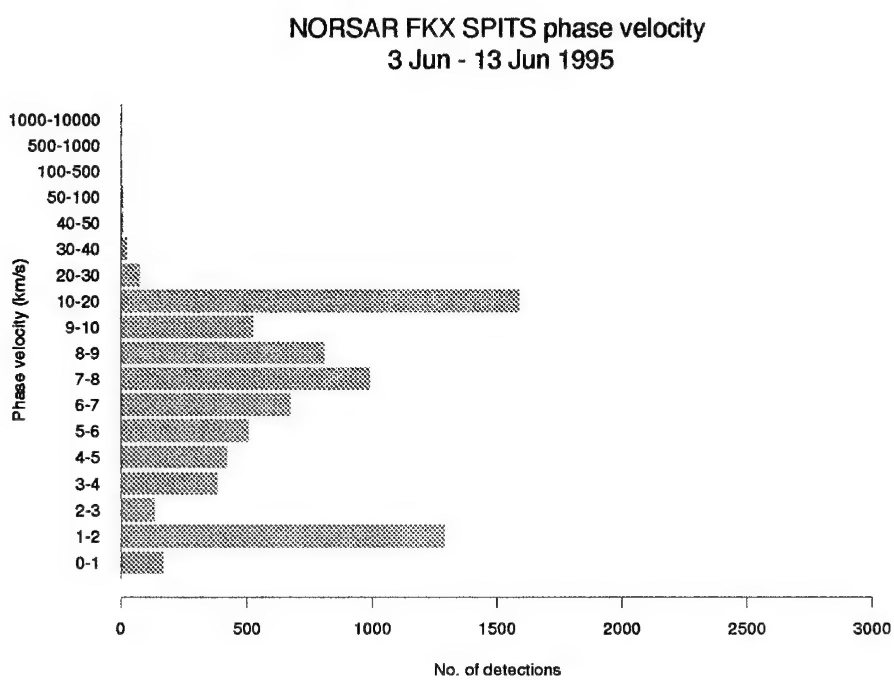
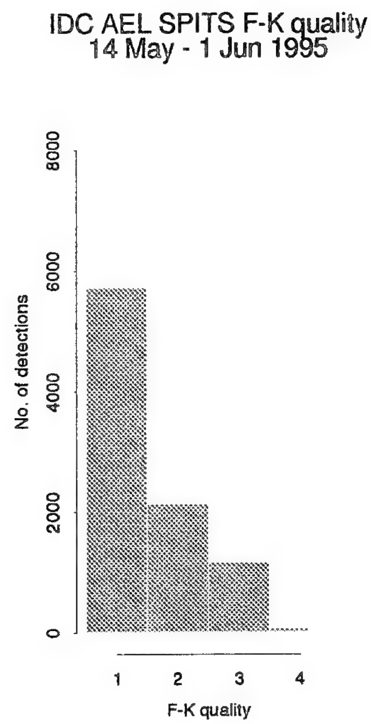


Fig. 7.5.3. Same as for Fig. 7.5.2, but for a time interval after the modification of the SigPro processing.



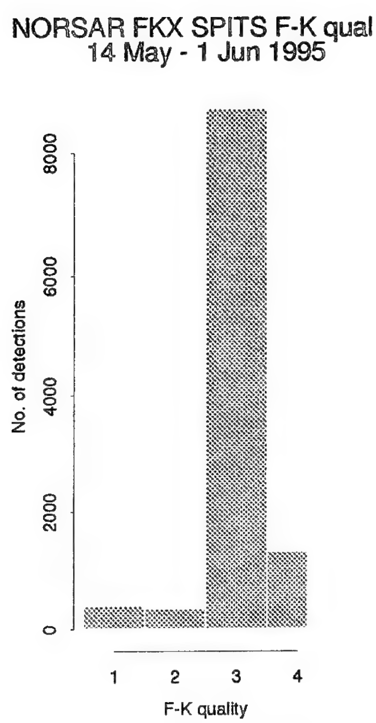
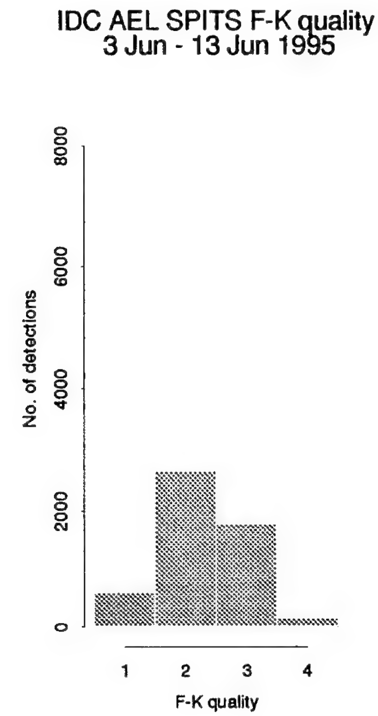


Fig. 7.5.4. f-k quality for Spitsbergen array detections by SigPro at the IDC (top) and by the dp/ep package at NORSAR (bottom) for a time interval before the modification to the SigPro processing.



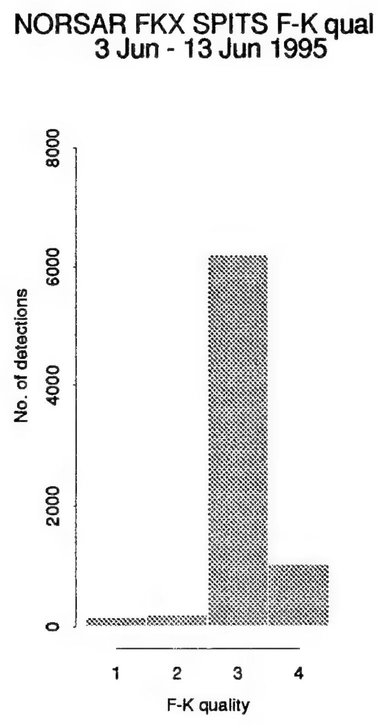


Fig. 7.5.5. Same as for Fig. 7.5.4, but for a time interval after the modification of the SigPro processing.

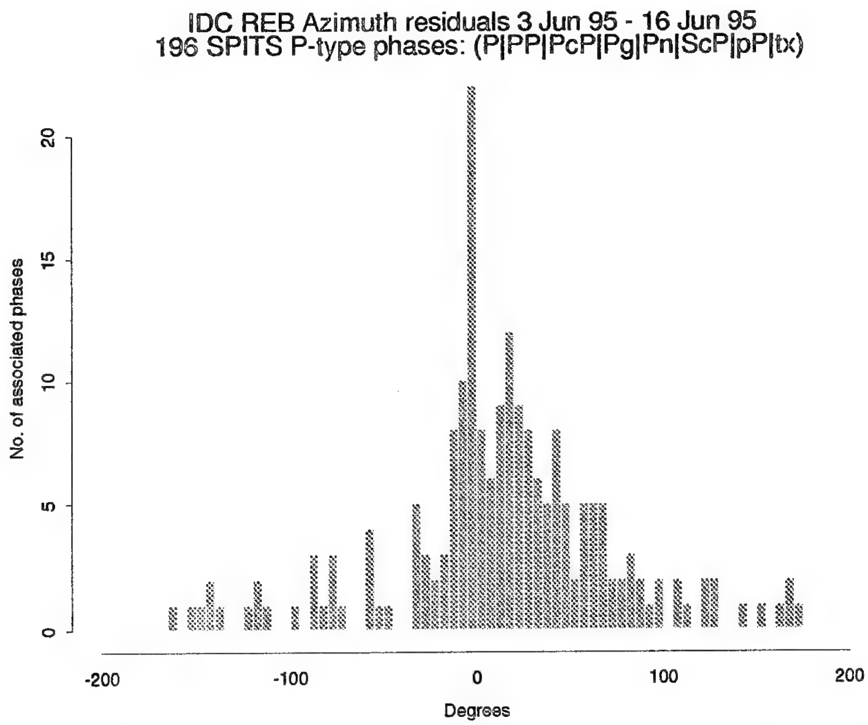


Fig. 7.5.6. P-wave REB azimuth residuals for the Spitsbergen array for a time interval after the modification of the SigPro processing.

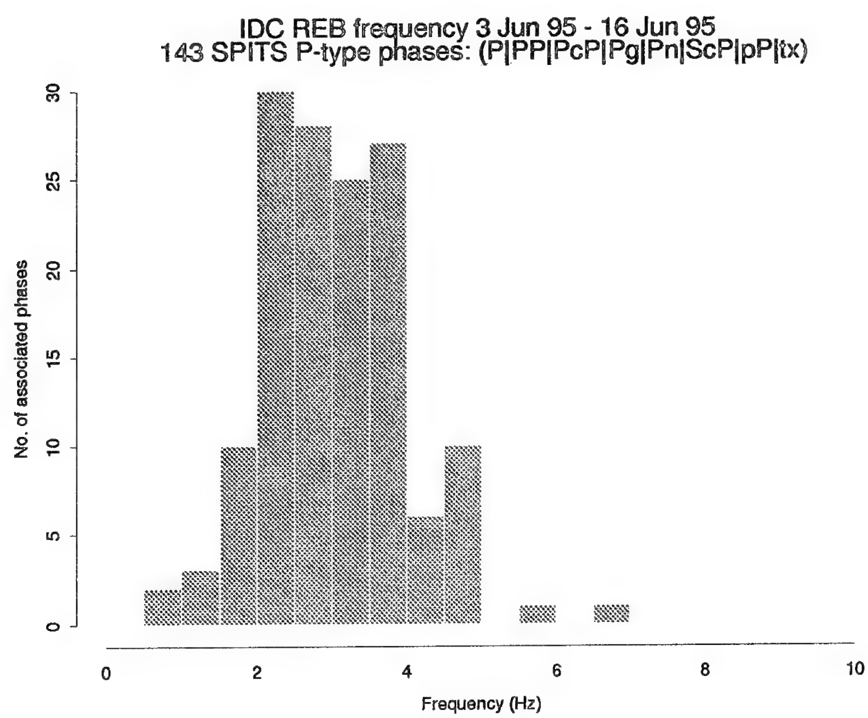


Fig. 7.5.7. Dominant signal frequencies for REB Spitsbergen P-wave arrivals for distances exceeding 20 degrees for a time interval after the modification of SigPro at the IDC.

7.6 Study of underground mining explosions in the Khibiny Massif

History of mining activity in Khibiny

The "Apatit" joint stock company is the largest enterprise in the world for phosphorus ore extracting and enrichment. The sources of raw material for the company are the apatite - nepheline deposits of the Khibiny massif. The massif is a great alkaline intrusion connected with a regional tectonic fracture. It has oval shape, a size of about 1300 square km (36x45 km) and is situated about 900-1000 m higher than the surrounding plain of the Kola peninsula.

Apatite - nepheline ores in Khibiny comprise thick (100-200 m) stratum-like deposits (Kukisvumchorr (Kirovsk), Yukspor, Rasvumchorr) as well as a system of ore seams of 25-50 m thickness (deposits Koashva, Nyurkpakh). The correspondence between these deposits and the mines (1-6) shown on Fig. 7.6.1 is given in Table 7.6.1. A more detailed map of mines 1-2 is given in Fig. 7.6.2.

Surface mining in Khibiny began in 1930 with 250,000 tons of apatite extracted during the first year. In 1934 the extraction volume had increased to 1,136,000 tons. In 1933 the construction of Kirovsk underground mine was initiated. The first ripple-fired explosion of mine charges was made in 1936 during the Kukisvumchorr deposit development. By 1936 the ore extraction had reached 2,6 million tons per year.

During most of the Second World War the mines were not in operation. Mining was restarted in 1944. The pre-war level of ore extraction was re-achieved in 1950.

In 1951 the construction of the Yukspor mine was started and in 1955 it began operation. Since 1963 the Rasvumchorr and Central mines have also been in operation.

From 1965 to 1980 the annual ore extraction increased from 19.1 to 46.5 million tons. Since 1980 the Vostochny mine, which covers the Koashva and Nyurkpakh deposits has been operational.

By the early 1990s the mining company had achieved its highest annual volume of the ore extraction - about 60 million tons. In the underground mines the volume was: Kirovsk mine — 11.3, Rasvumchorr — 5.4, Yukspor — 5.1, and in the open mines: Central — 25, Vostochny — 7.0 million t. The rest of the volume was extracted by surface mining at the Northern and Saamsky open mines of Kirovsk and at the mountain part of the Rasvumchorr mine.

Nowadays Kirovsk and Yukspor mines are operated jointly and the work of the Nyurkpakh open mine is finished. Total volume of ore extraction in 1994 was 21 million tons: joint Kirovsk mine — 7,046,000 tons (994,000 tons from open mines), Central mine — 8,382,000 tons, Vostochny mine (Koashva deposit) — 4,081,000 tons, Rasvumchorr mine — 1,500,000 tons (400,000 tons from open mines).

Underground explosions

Analysis of ripple-fired explosions carried out at underground mines during 1981-1994 shows that since 1981 the average explosion size has increased from 68 to 140 tons of explosive material (EM). Since 1988, the average total charge size of ripple-fired explosions has been within the range 120 - 240 tons of EM, all of the largest ones (>180 tons) taking place at the southern part of the Kirovsk mine and at the horizon +320 m of the Yukspor mine.

At the same time as the total charge of ripple-fired explosions has increased, the typical maximum individual charge size has also gone up, from 11 to 27 tons and it sometimes amounts to as much as 35 tons. The time delay of the largest individual charge (commonly the 3rd one) is typically 46-69 ms after initiation.

Nowadays the average number of underground explosions per year is about 40, and most of the explosions take place during the 1st and 4th quarters of the year.

Open explosions

Ripple-fired explosions at the Central and Koashva mines are carried out weekly. During an explosion day (commonly Friday) 1-5 such explosions take place. Average release of explosive material for such a day amounts to 150-180 t. The maximal volume of fractured ore is about 500,000 cubic meters.

The technique in use is multi-row explosions with short delaying intervals (about 35 ms) using diagonal and diagonal-radial schemes. Average weight of EM per delaying phase is 2-3 tons and it sometimes amounts to 9 tons.

Blocks are exploded sequentially with time delays from 1 to 5 seconds. If the blocks are close to each other the simultaneous initiation of two blocks is possible (cascade exploding). Otherwise, if the blocks are far from each other, the time delay between the respective explosions may be up to 5-10 min.

The explosions at the open mines of Kirovsk usually are combined with underground explosions, but are carried out after them. Typical total weight of EM for the open mines is 10-15 tons, with 2-3 tons per delaying phase.

The open explosions at Rasvumchorr mine are not usually combined with underground ones. The total weight of EM is not more than 15 tons, with typically 2 tons per delaying phase, and a delay interval of 35 ms.

Data analysis of underground explosions

Table 7.6.2 lists underground explosions at Khibiny for the three years 1991-93. The table contains information on mine number, seismic magnitudes (local magnitude M_L and coda magnitude M_C), as well as the total yield (weight of explosive material).

We recall that there are 6 mines (with different kinds of explosions) in Khibiny. Mines 1, 2 and 3 have underground parts and quarries, whereas at mines 4, 5 and 6 there are open (quarry) explosions only. At mines 1 and 2 the underground and open (quarry) explosions take place on the same day (sometimes at very close times, with delays from seconds to hours). At mine 3 underground and open explosions are usually carried out on different days.

The underground explosions are single (ripple-fired) explosions with typical shot delays of 20-35 ms and typical total duration of a few hundred milliseconds.

The quarry explosions are made by separate charges situated at different places (distances up to 2 km) and the time shift between the individual explosions amounts to dozens of minutes.

Aggregate yield (total weight of explosive material) is:

15-400 t for underground explosions (mines 1,2,3, single (ripple-fired) charge);
0.5-50 t for quarry explosions at mines 1,2,3 (separate charges)
10-400 t for quarry explosions at mines 4,5,6 (separate charges)

The main source of information on types and yields of the explosions is the mine administration, whereas data on their times and magnitudes are taken from our seismic recordings.

When we started to study mining explosions in 1994, we found no direct correlation between aggregate yields of explosions and their magnitudes. For example, the data listed by Mykkeltveit (1992) show no distinct trend between magnitude and total yield. We have found that there are several reasons for this:

- numerous errors in messages from the mine staff
- different characteristics of open and underground explosions
- for open explosions it is impossible to determine which charge was exploded first
- impossiblity to separate simultaneous open and underground explosions
- absence of exact information about the times of explosions
- sometimes rockbursts take place immediately after an explosion, influencing the recording and, hence, the magnitude.

We have carefully checked our data and selected only underground explosions which are well distinguishable from rockbursts and open explosions (total 111 underground explosions at mines 1,2,3) and calculated the following parameters (see Tables 7.6.3 and 7.6.4):

$$\mathrm{Corr}(\log(Y), M_L) = 0.71, \qquad \mathrm{Corr}(\log(Y), M_C) = 0.73$$

$$\left\langle \frac{\log(Y)}{M_L} \right\rangle = 0.85 \pm 0.18 \qquad \left\langle \frac{\log(Y)}{M_C} \right\rangle = 0.77 \pm 0.10$$

This shows that the correlation is statistically reliable. Plots of log(Yield) versus magnitude are given in Figs. 7.6.3 and 7.6.4.

In addition we used a rank-order test to estimate the quantitative agreement between yields of underground explosions and their magnitudes (M_L). We checked the possibility to predict relative yields given the magnitudes, i.e., P(Y1>Y2) when $M_L1 > M_L2$. We used 105 explosions, and for all pairs of them calculated the number of cases when the sequence of yields coincides with the sequence of magnitudes (N good) and otherwise (N bad).

N total	=	5460 (105*104/2)
N good	=	3977 (about 73%)
N bad	=	1483

The number 73% is slightly higher than the linear correlation, and confirms that the yields and magnitudes are indeed correlated.

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V.E. Asming, KRSC, Apatity, Russia
F. Ringdal, NORSAR

References

Kremenetskaya, E.O. & V. M. Trjapitsin (1995): Induced seismicity in the Khibiny Massif (Kola Peninsula), PAGEOPH Vol 145, No 1 (in press).

Mykkeltveit, S. (1992): Mining explosions in the Khibiny Massif (Kola Peninsula of Russia) recorded at the Apatity three-component station. Report PL-TR-92-2253, Phillips Laboratory, Hanscom AFB, MA, USA.

Deposit	Mine No.
Kirovsk, Kukisvumchorr	1
Yukspor	2
Rasvumchorr	3
Central	4
Koashva	5
Nyurpakh	6

Table 7.6.1. Reference numbers of the Khibiny mines.

Date	Time	Mine	ML	MC	Yield
1991 01 13	04 32 35.6	1	2.5335	2.4345	130
1991 01 26	18 30 34	3	2.5339	2.5475	150
1991 02 03	04 57 08.1	2	2.8701	2.7559	130
1991 02 10	03 11 04.8	2	2.2010	2.4378	56
1991 02 17	03 44 55.2	2	1.7697	2.3681	64
1991 02 23	12 08 41.5	3	2.1747	2.3980	60
1991 02 24	08 45 17.1	1	2.4953	2.7189	187
1991 02 24	11 11 15.9	2	2.2010	2.5188	142
1991 03 08	04 42 52.5	1	2.5335	2.4869	156
1991 03 24	04 23 17	2	2.3825	2.6927	89
1991 03 24	04 48 58.4	2	2.6877	2.5509	118
1991 03 31	06 29 37.1	2	2.4738	2.5419	211
1991 04 13	17 59 27.4	3	1.7540	2.3352	70
1991 04 21	06 40 05	1	2.3574	2.5486	118
1991 04 27	13 14 14.5	3	2.105	2.3737	130
1991 04 28	05 18 47.4	1	2.7206	2.7	150
1991 05 18	12 43 12.1	3	2.3561	2.5338	90
1991 05 19	08 47 13	1	2.5597	2.7581	225
1991 05 19	08 47 13	2	?	?	61
1991 06 16	05 39 49.9	2	2.4011	2.6142	112
1991 06 23	04 14 00.4	2	2.2802	2.4432	82
1991 06 30	06 33 00.9	2	2.5021	2.5855	117
1991 07 06	19 23 58.7	3	2.2811	2.2862	94
1991 07 07	05 33 35.4	1	2.3692	2.4561	133
1991 08 04	12 49 52.1	1	2.7143	2.6550	122
1991 08 10	18 00 02.1	3	1.9863	2.2154	50
1991 08 18	06 11 44.5	2	2.2882	2.5235	90
1991 08 31	16 08 20.4	3	2.0333	2.1226	100
1991 09 01	06 17 16.5	2	2.3012	2.4592	168

Date	Time	Mine	ML	MC	Yield
1991 09 15	04 07 42.8	1	2.2617	2.5303	57
1991 10 06	05 37 17.2	2	2.8631	2.7559	114
1991 10 20	04 36 59.3	2	2.1352	2.3681	112
1991 10 26	13 03 13.3	3	2.0389	2.3548	30
1991 10 27	01 32 32.1	2	1.8489	2.2504	15.4
1991 11 16	12 35 33.8	3	1.9406	2.1712	52
1991 11 17	04 59 19	1	2.4237	2.3703	150
1991 11 30	13 12 52.5	3	2.0857	2.2320	70
1991 12 08	08 29 30.6	1	2.2557	2.6242	167
1991 12 15	05 55 41.5	2	2.3260	2.4378	70
1991 12 22	07 25 35.1	2	2.5536	2.6142	238
1991 12 28	15 32 00.6	3	2.4572	2.7616	171
1991 12 31	08 48 48.5	1	2.4091	2.5349	198
1992 01 18	12 44 42.7	3	2	2.3	71
1992 02 02	05 05 00.4	1	2.7338	2.6913	107
1992 02 08	11 25 24.7	3	1.5726	2.1122	16
1992 02 09	04 09 40.8	2	3.0072	2.6021	116
1992 02 16	08 49 49.7	1	2.3226	2.7018	175
1992 02 22	12 00 19	3	2.1190	2.4489	60
1992 02 23	05 37 02.9	2	2.6035	2.6821	101
1992 04 19	02 33 22.1	2	2.4436	2.5141	48
1992 04 25	13 38 59.9	3	2.7035	2.6769	150
1992 04 26	03 31 56.7	1	2.4665	2.5018	84
1992 05 01	02 14 11.7	3	1.9194	2.4542	60
1992 05 01	03 02 56.8	1	2.8776	2.7018	150
1992 05 24	04 29 57.2	2	1.7239	?	112
1992 05 24	04 30 06.2	2	1.6929	?	106
1992 05 31	02 46 41.7	2	1.2168	2.2581	25
1992 05 31	03 41 10.1	1	2.4154	2.6770	217
1992 06 07	03 47 36.9	2	2.3717	2.6749	103

Date	Time	Mine	ML	MC	Yield
1992 06 19	11 23 35.1	3	2.2204	2.5521	80
1992 07 05	04 01 39.1	2	2.3717	2.7559	118
1992 07 12	03 24 46.4	1	2.1542	2.7087	103
1992 07 26	03 56 06.3	2	2.2106	2.5093	38
1992 08 22	10 33 54.9	3	2.2204	?	45.5
1992 08 23	03 10 43.5	2	2.5179	2.7777	60
1992 08 30	03 11 56.4	1	2.8167	2.8183	91
1992 09 27	05 22 35.8	2	2.6294	2.8162	198
1992 10 18	03 24 08.9	2	2.1847	2.4268	25
1992 11 07	06 31 43.4	1	2.5657	2.7949	177
1992 11 21	12 29 56.6	3	2.0944	2.4596	96
1992 11 22	04 46 44.8	2	2.7082	2.7685	99
1992 11 29	04 08 46.1	2	2.0250	2.6142	119
1992 12 05	10 42 30.8	3	2.2311	2.3799	70
1992 12 20	07 10 46	1	2.4358	2.5162	163
1992 12 31	04 35 17.9	2	2.4857	2.4948	89
1993 01 16	11 00 00	3	?	?	15
1993 01 24	08 04 42.9	2	1.7428	?	26
1993 01 30	13 07 08.9	3	2.5976	2.6622	272
1993 01 31	04 14 05.9	1	2.3940	2.4177	148
1993 02 13	12 05 34.8	3	2.5628	2.8	148
1993 02 14	07 39 39.7	1	2.6237	2.5210	182
1993 02 28	04 23 56.4	2	1.6260	2.1748	27
1993 03 06	11 00 31	3	2.2716	?	134
1993 03 07	04 14 31.3	2	2.1641	2.4212	57
1993 03 28	04 48 02.6	2	2.3761	2.6927	219
1993 04 03	08 29 16.6	3	1.2204	?	45
1993 04 04	03 22 22	2	2.3260	2.6061	88
1993 04 10	08 28 56.8	3	1.3220	2.1122	15
1993 04 11	03 45 44.6	2	2.2351	2.3228	30

Date	Time	Mine	ML	MC	Yield
1993 04 18	03 17 54.6	1	2.2434	2.6913	127
1993 04 30	23 21 37.2	1	2.1	2.4	17
1993 05 09	03 14 45.1	2	2.3472	2.6892	98
1993 05 23	02 36 09.5	1	2.7408	2.5018	196
1993 06 20	02 28 18.1	1	2.3278	2.4666	73
1993 06 27	02 42 07.2	2	2.5731	2.5553	71
1993 07 03	10 01 15.4	3	1.9194	2.2935	60.5
1993 07 18	02 57 12.1	2	2.616	2.5374	117
1993 07 25	06 43 52.8	2	1.8341	2.1169	16
1993 08 01	08 57 19.2	1	1.0694	1.8827	22
1993 08 05	04 42 11.6	2	1.8836	?	22
1993 08 21	13 25 16.1	3	1.7847	2.1226	40
1993 08 22	02 21 46.2	1	2.7418	2.4177	75
1993 09 05	04 29 45.2	2	2.5826	2.7653	249
1993 09 19	05 20 34.7	2	2.8742	2.7031	140
1993 09 19	07 00 37.7	2	1.1499	1.9138	24
1993 10 03	03 52 30.8	2	2.6035	2.6338	167
1993 10 10	03 34 16.3	2	2.4011	2.3983	44
1993 10 24	05 34 25.4	1	2.7610	2.4062	43
1993 11 20	18 46 54.3	3	1.4423	2.1327	13
1993 12 05	06 50 18.1	1	2.5744	2.7612	254
1993 12 31	08 01 48.3	2	2.6148	2.8497	360

Table 7.6.2. List of underground explosions in Khibiny during 1991-1993.

	log(Yield)	M_L	M_C
log(Yield)	-----	0.7059	0.7323
M_L	0.7059	------	0.7954
M_C	0.7323	0.7954	------

Table 7.6.3. Correlation matrix for M_L and M_C versus log(Yield)

	log(Y)/M_L	log(Y)/M_C
Number of known values*	109	102
Min	0.5859	0.51270
Max	1.3546	0.94220
Average	0.8606	0.77400
Standard deviation	0.1334	0.09557

*The numbers are less than 111 because for some explosions M_L or M_C are unknown.

Table 7.6.4. Statistical parameters for log(Y)/M_L and log(Y)/M_C.

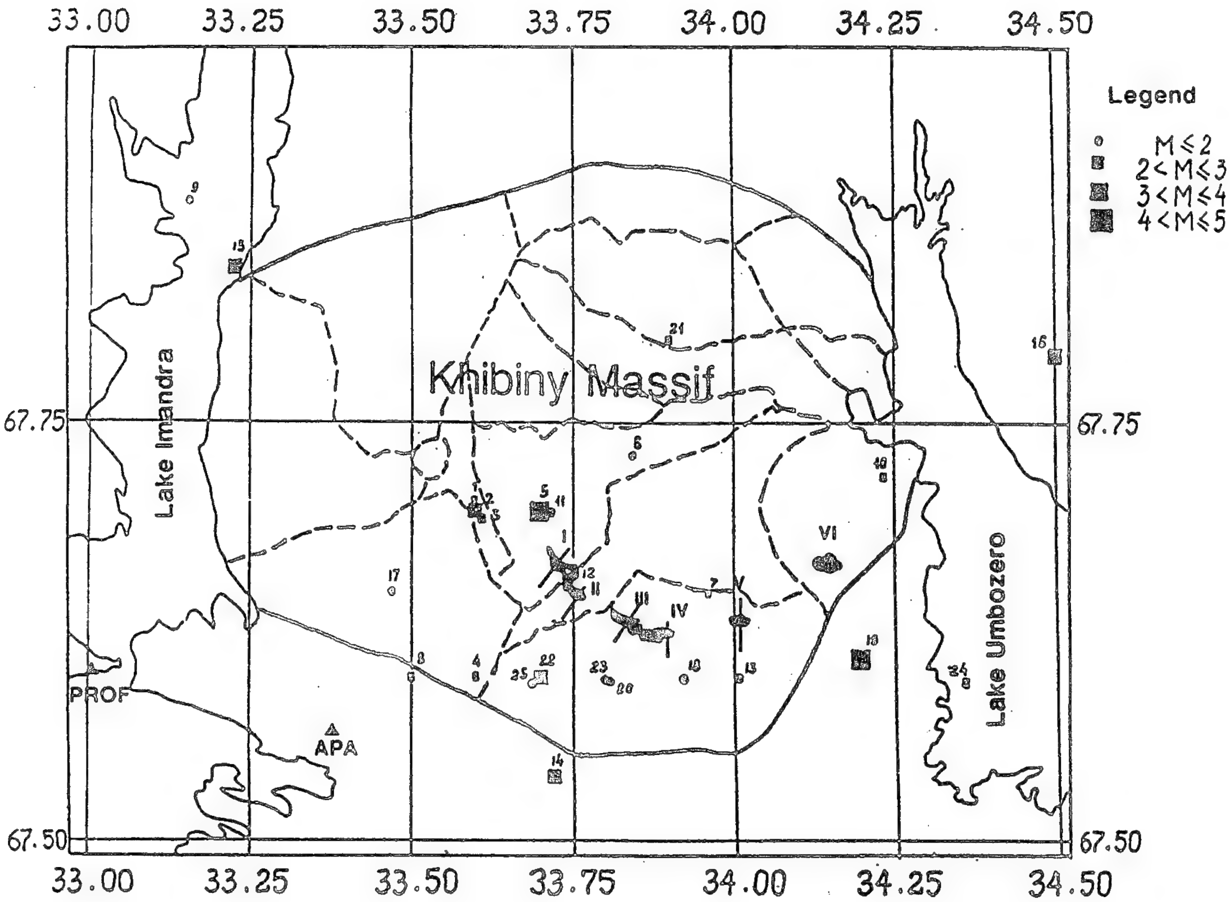

Fig. 7.6.1. The position of mines (I-VI) in the Khibiny Massif together with fault structures and earthquakes. Mines I, II and III are underground, whereas IV, V and VI are open-pit mines. The location of the Apatity seismic station (APA) is also shown. (After Kremenetskaya and Trjapitsin, 1995.)

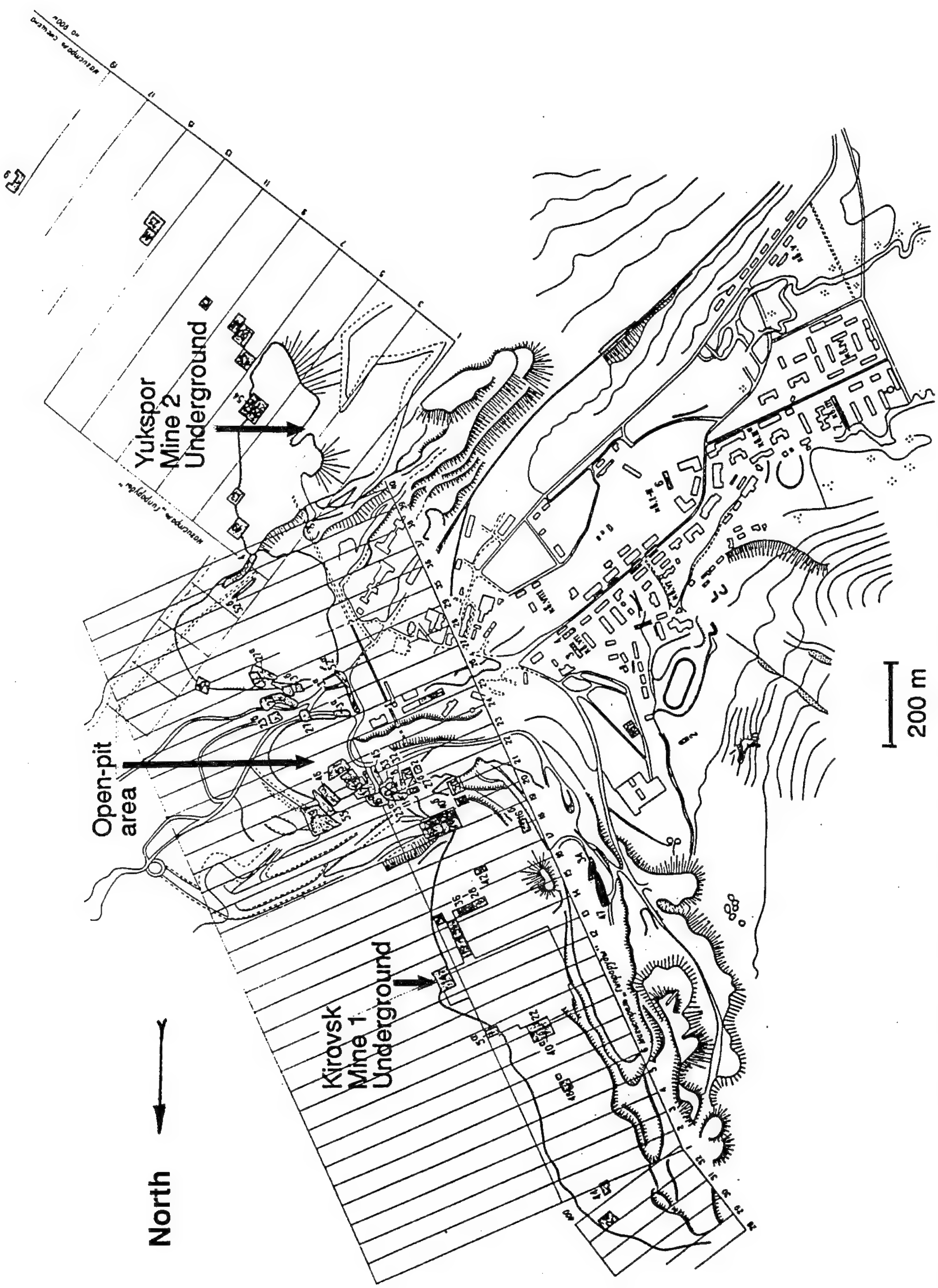

Fig. 7.6.2. Schematic plan of Mines 1 and 2. Part of the town Kirovsk is seen on the map.

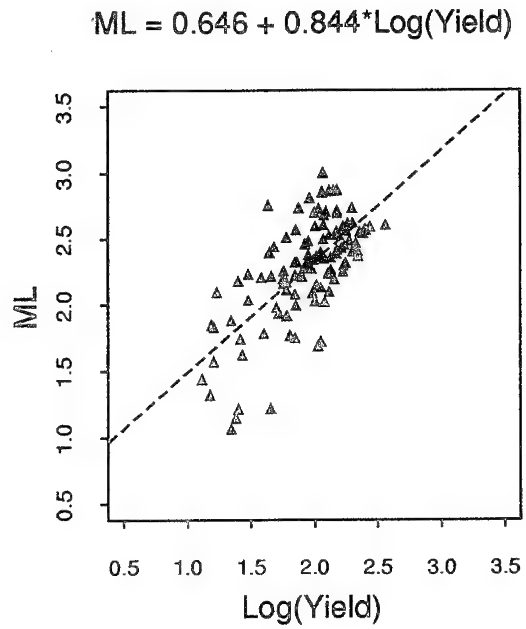

Fig. 7.6.3 Plot of M_L versus log(Yield) (in tons) for underground explosions listed in Table 7.6.2.

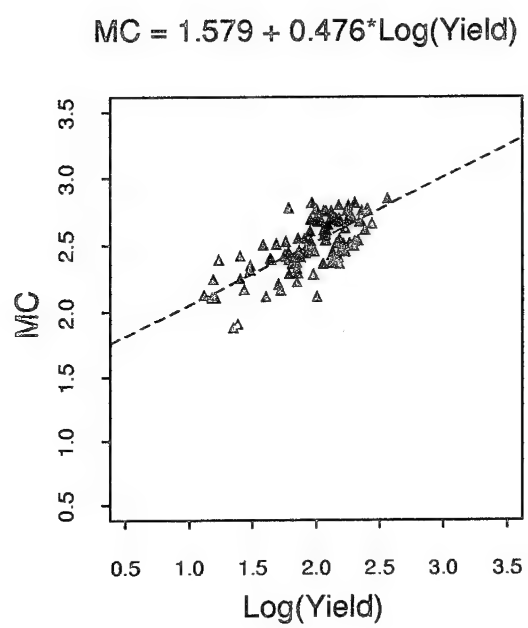

Fig. 7.6.4 Plot of M_C versus log(Yield) (in tons) for underground explosions listed in Table 7.6.2.

7.7 Initial results of a newly installed acoustic array in Apatity

During the summer of 1994 a new type of sensors was incorporated in the existing data acquisition system of the Kola Regional Seismological Centre (KRSC) of the Russian Academy of Science (RAS). Three liquid microbarographs were installed at the Apatity seismic array site making up a triangle with the vertices beside the A1, A2 and A3 seismic sensors.

There are many natural and artificial phenomena that may be analyzed by such a device. Since the 1970s, there has been steady interest in developing an infrasound data acquisition system to detect, locate, identify and investigate the infrasonic waves generated by volcanoes (Tahira, 1982), ionospheric disturbances and geomagnetic activity in the polar regions (Maeda and Watanabe, 1964; Wilson, 1975), meteor-generated infrasound (Revelle et al, 1975), and infrasonic signals from thunderstorms (Few, 1970; Pibner & Rey, 1982). Microbarographs or geophones are widely used to provide an additional source of information to be utilized in detecting explosions (Cox et al, 1954; Glasstone & Dolan, 1977; Reed, 1989), rockets (Kaschak et al, 1970; Donn et al, 1975) and in investigations of stratosphere winds and temperatures (Rind & Donn, 1978).

Fig. 7.7.1 displays the array geometry along with the newly installed devices.

Installation and testing

Liquid microbarographs allow recording of infrasound signals in the most interesting frequency range 0.01-1 Hz and are simple to operate. This is the reason why this type of sensor has been selected.

A typical liquid microbarograph design is shown in Fig. 7.7.2. One of the input holes (4) is kept open into the atmosphere; the other is coupled with a volume (not shown) separated from the atmosphere. The relative liquid level in the capacitors (2) changes under a difference between the atmospheric pressure and the pressure in the volume. Deviations of the liquid level from the balance are transformed into an electric signal by a capacity-voltage converter.

Microbarographs are installed on concrete basements coupled with the bedrock. The outputs are connected to the analog-to-digital converter (ADC) in the central hub by symmetric communication lines in order to suppress interference. Three spare channels of the existing data acquisition system, sampling rate 40 Hz, were used to transfer data to the KRSC in Apatity. The effective frequency band of infrasound data is restricted to 0.1-1 Hz because these channels were originally designated to register seismic data with a sampling rate of 40 Hz. Therefore the frequency band and sampling rate are not quite conforming with infrasound signals. However, the bandwidth is large enough to record most interesting phenomena except the internal gravitational waves and pressure disturbances stimulated by aurora.

The operation of a set of infrasound sensors and of a seismic array is similar, therefore the microbarographs' relative phase responses should be either identical or carefully measured. To obtain the relative phase shifts the following measurements have been made:

All sensors were placed close to one another near the central hub and were linked with the data acquisition system. The input holes of sensors normally opened into the atmosphere were coupled by rubber tubes with a single puncture. Such a connection implies that the pressure in the measuring chambers of the microbarographs will be identical; thus the phase shifts between sensor outputs yield the relative phase responses. The data were recorded during several hours. For further processing, time histories free of spikes of about an hour in length have been chosen. To estimate relative phase shifts and coherency of signals, the method described in Bendat and Piersol (1986) has been applied.

Fig. 7.7.3a shows the coherency of the output signal; Fig. 7.7.3b represents the phase shifts. The high coherency of the analyzed signals confirms that the estimates are confident. These results will be used further by more comprehensive software when estimating arrival angles of infrasound signals.

The next step was to assess the threshold sensitivity. Fig. 7.7.4a and 7.7.4b show the response of the recording system obtained by imposing a step function 25.0 dyne/cm^2 and 2.5 dyne/cm^2 amplitude to the input of a microbarograph, respectively. In spite of this estimation being quite rough, it can be concluded that the threshold pressure sensitivity is of the order of 1 dyne/cm^2.

Software installed at the SUN workstation in KRSC extracts infrasound data from the data stream, filters it by an anti-aliasing Butterworth low pass filter with corner frequency 1.5 Hz and slope 80 dB/decade, resamples it to 4 Hz sampling rate and stores the outcome on the hard disk afterwards.

Infrasound recordings are often affected by wind-initiated air turbulence near the ground; hence careful data selection is necessary before the processing. An effective indicator of a true infrasound signal is the coherency between the sensor outputs. Fig. 7.7.5a and 7.7.5b present two samples of the quick-look plots obtained by calculating coherency spectra between MB1 and MB2 during 15-minute time intervals. The first sample may be associated with either a windy day when coherence was zeroed by uncorrelated noise or with the absence of an infrasound signal. The second sample shows two bursts of coherent signals for which further processing can be advantageous.

Initial recordings

As an sample illustrating the interaction of a seismo-acoustic system, we present two recordings of quarry explosions at the Rassvumchorr plateau (Khibiny Massif) about 33 km from the array site. In Figs. 7.7.6 and 7.7.7 the three top traces represent the acoustic data, whereas the next 15 traces are recordings of 9 Apatity seismic array elements, together with the broad-band 3-component station (APZ9) in the city of Apatity and the high-frequency 3-component station situated at the center of the array site.

As is clearly seen from these figures, the installed infrasound sensors integrated into the existing data acquisition system KRSC RAS may be successfully used for investigating artificial and natural disturbances in the atmosphere.

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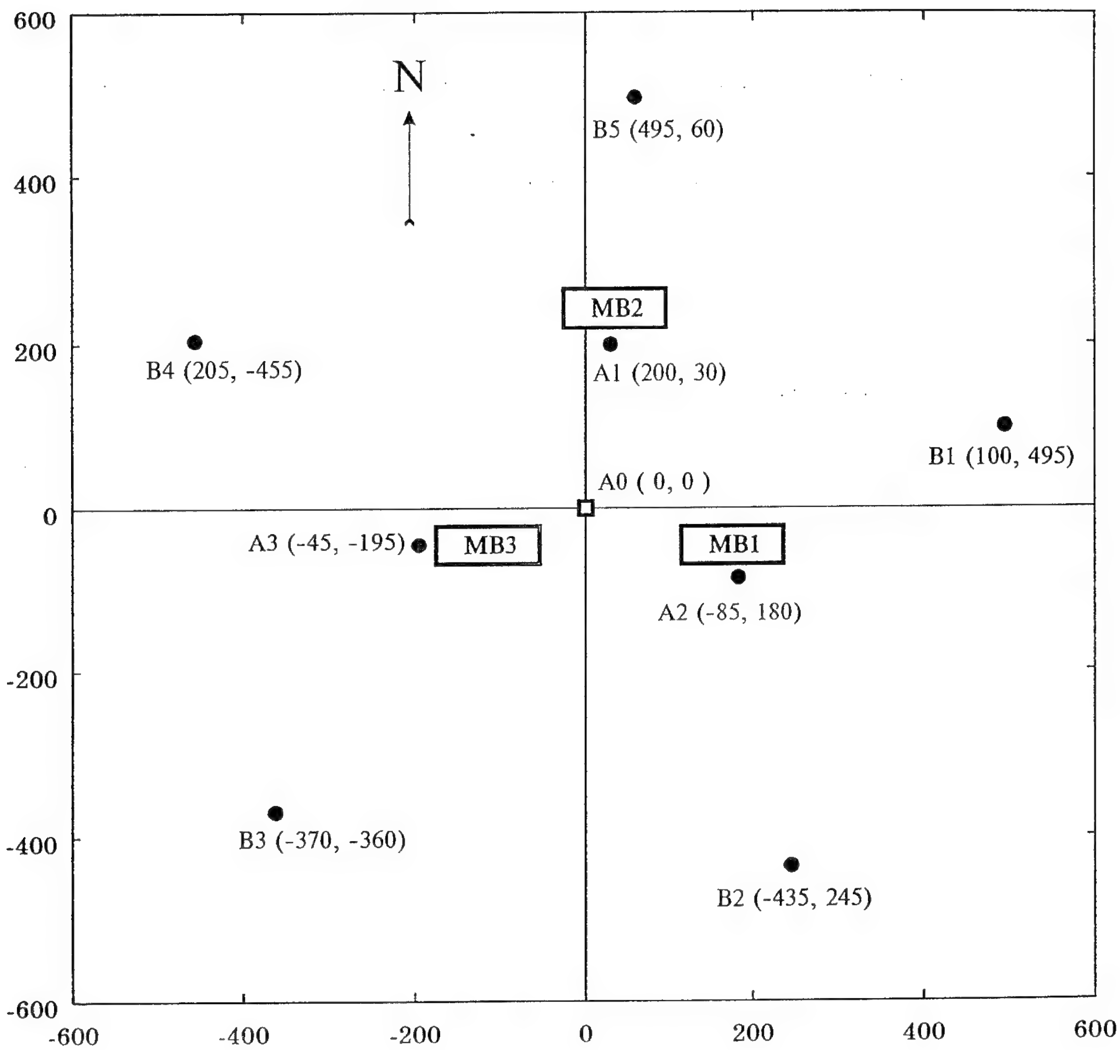

Fig. 7.7.1. Array geometry along with the infrasound sensors (microbarographs). Values in parentheses indicate position with respect to center in meters. MB1, MB2, MB3 denote the microbarographs.

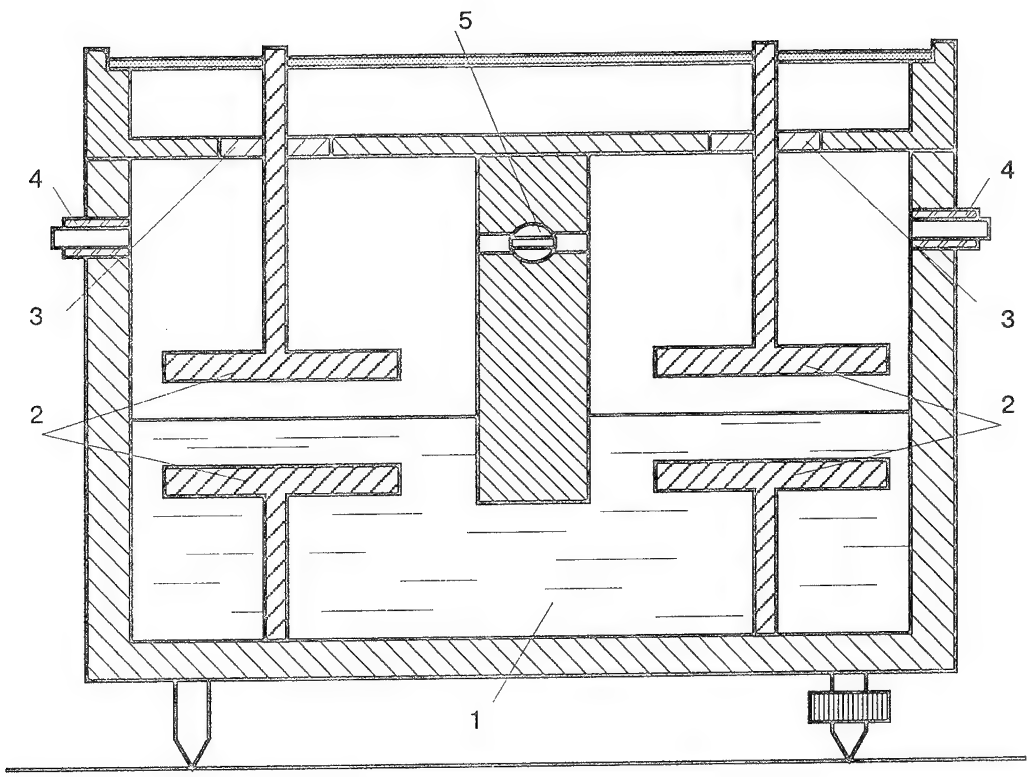

Fig. 7.7.2 Liquid microbarograph design. 1 — dielectric liquid (oil); 2 — capacitors; 3 — isolator; 4 — input holes; 5 — tap.

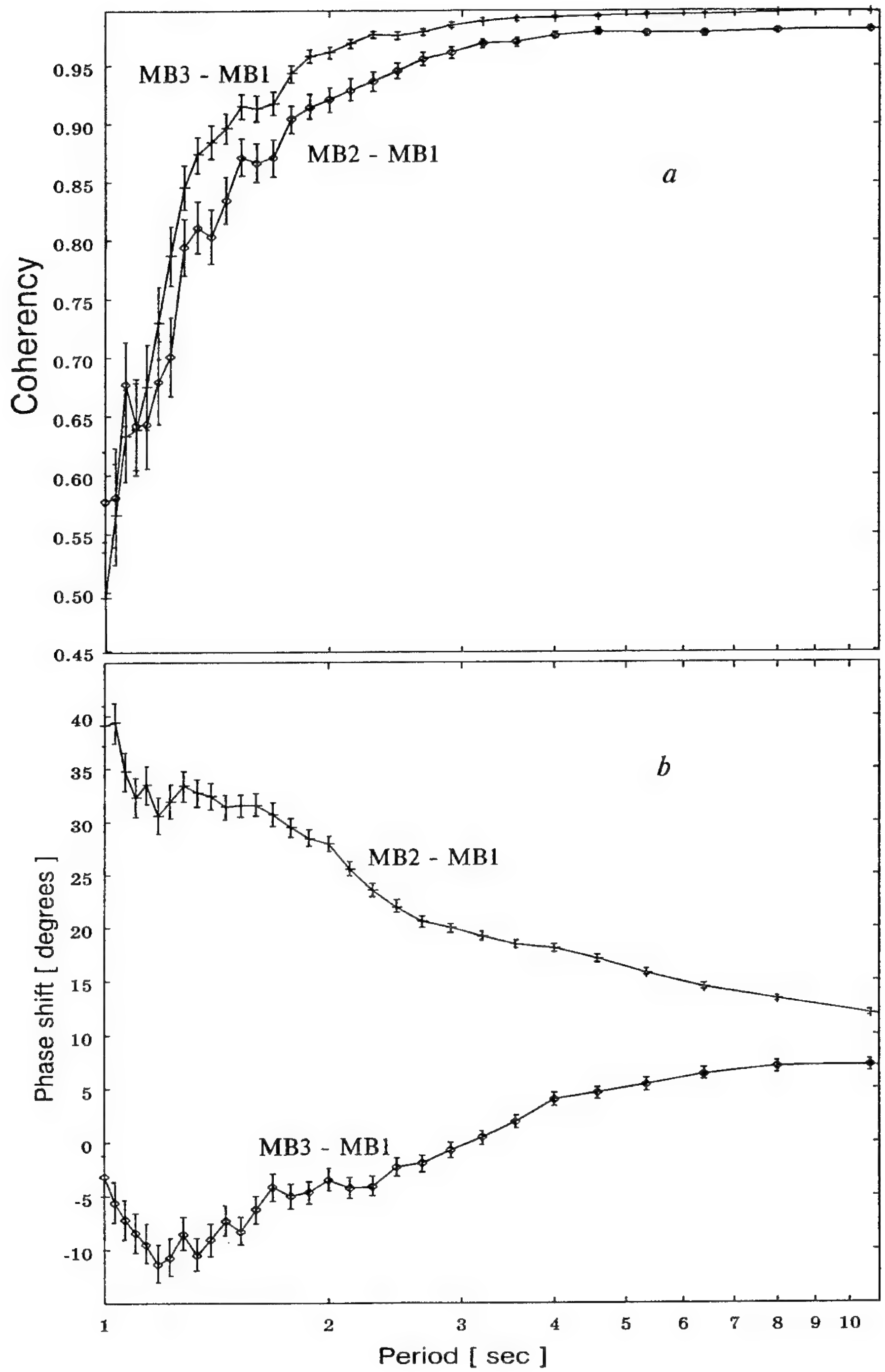

Fig. 7.7.3 Coherency (upper panel) and relative phase responses (lower panel) vs period. Vertical bars show 95% confidence interval. Coherency and phase shifts are measured between pairs of instruments and are marked MB2-MB1 and MB3-MB1, respectively.

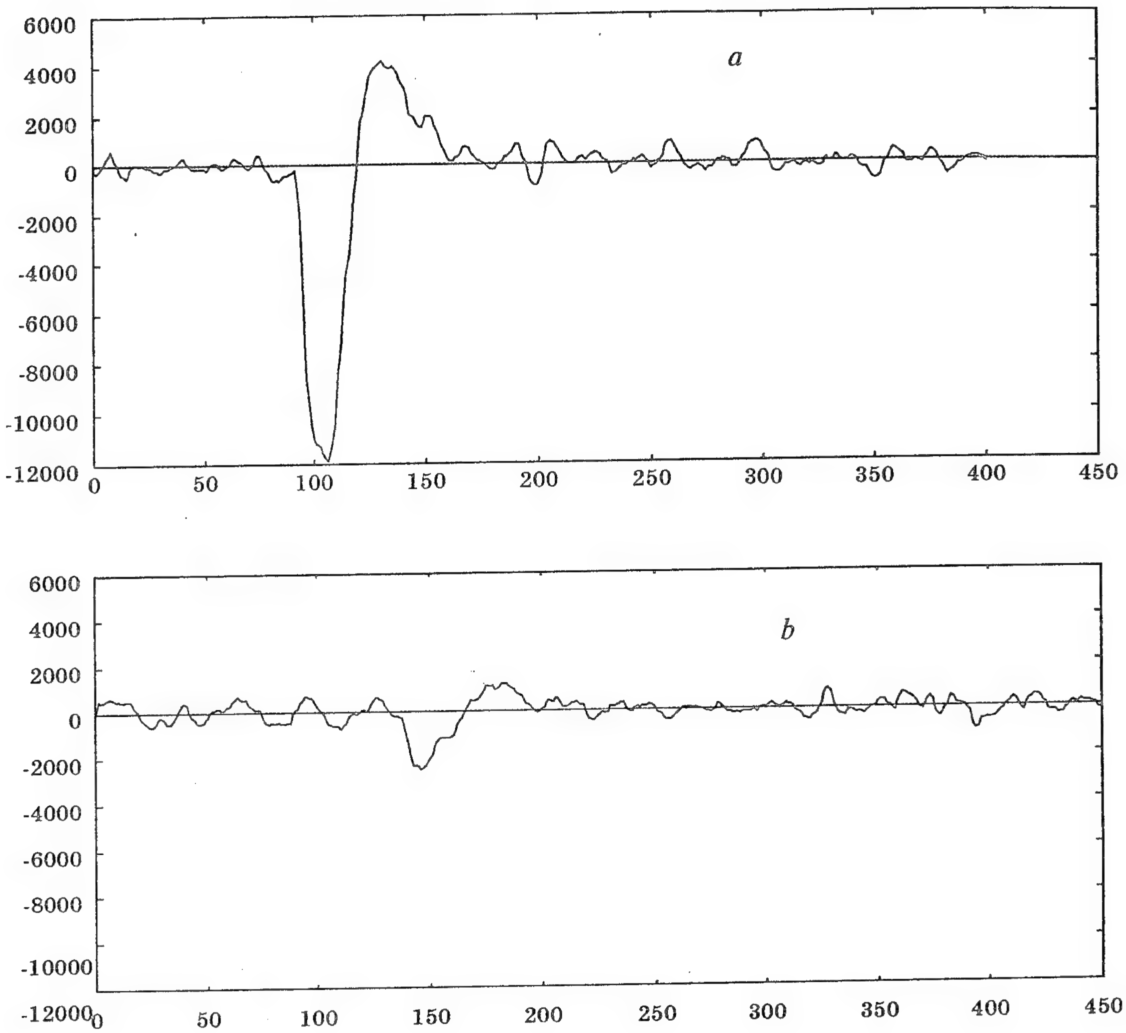

Fig. 7.7.4 Response of the recording system to a pressure step function 25 dyne/cm^2 (upper plot) and 2.5 dyne/cm^2 (lower plot).

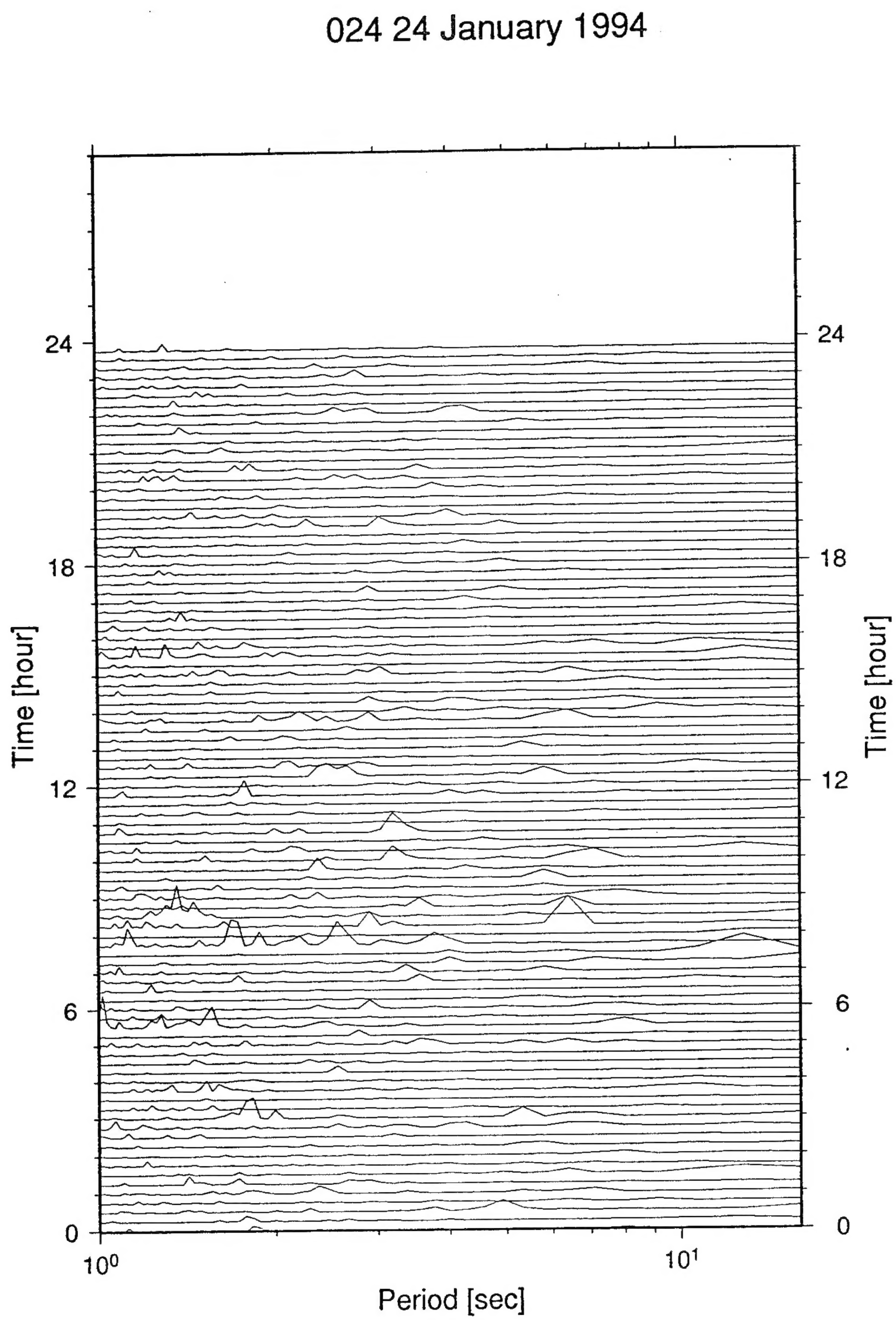

Fig. 7.7.5a Coherency spectra vs time during noise conditions (24 January 1994).

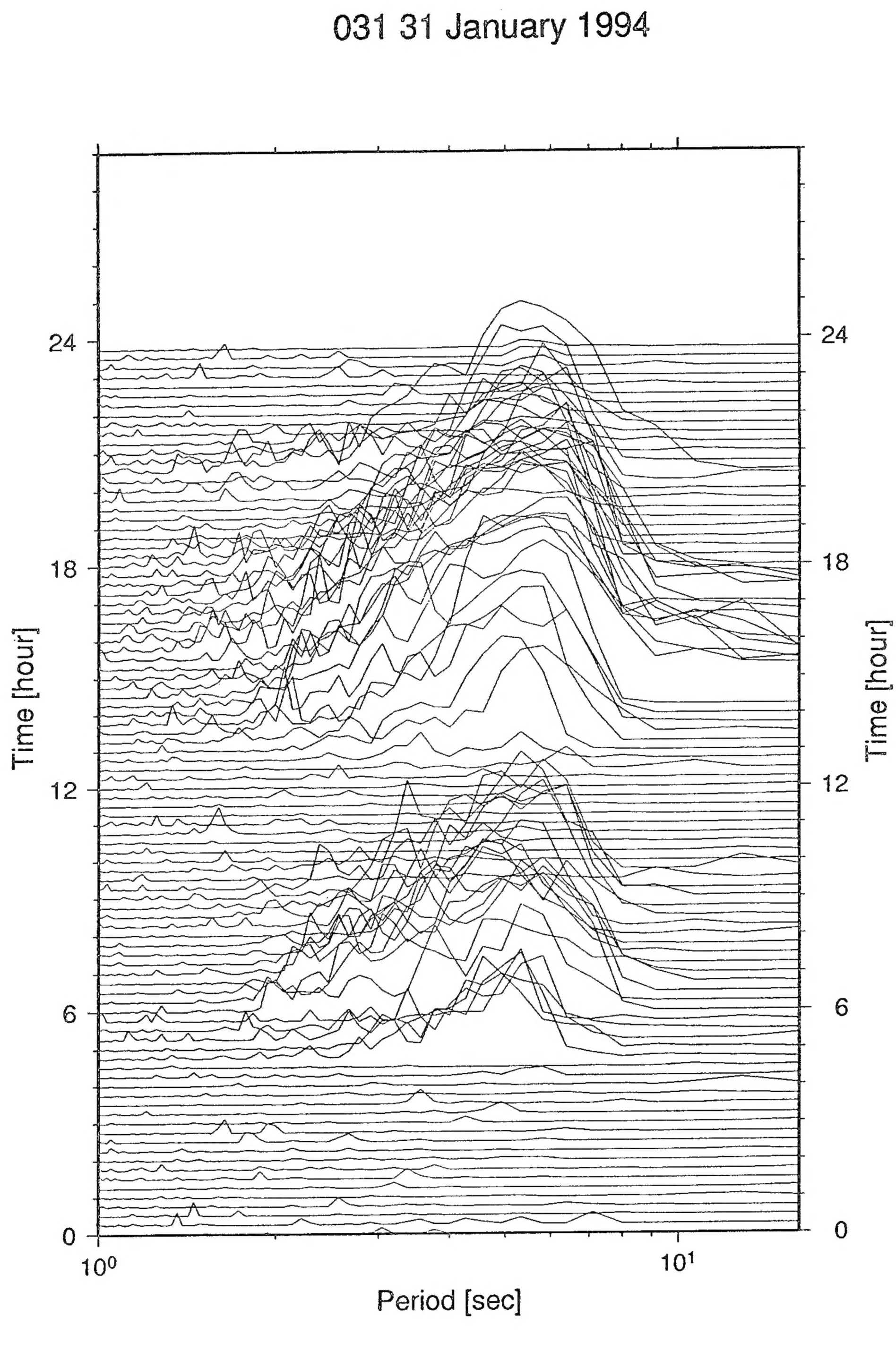

Fig. 7.7.5b Coherency spectra vs time 31 January 1994.

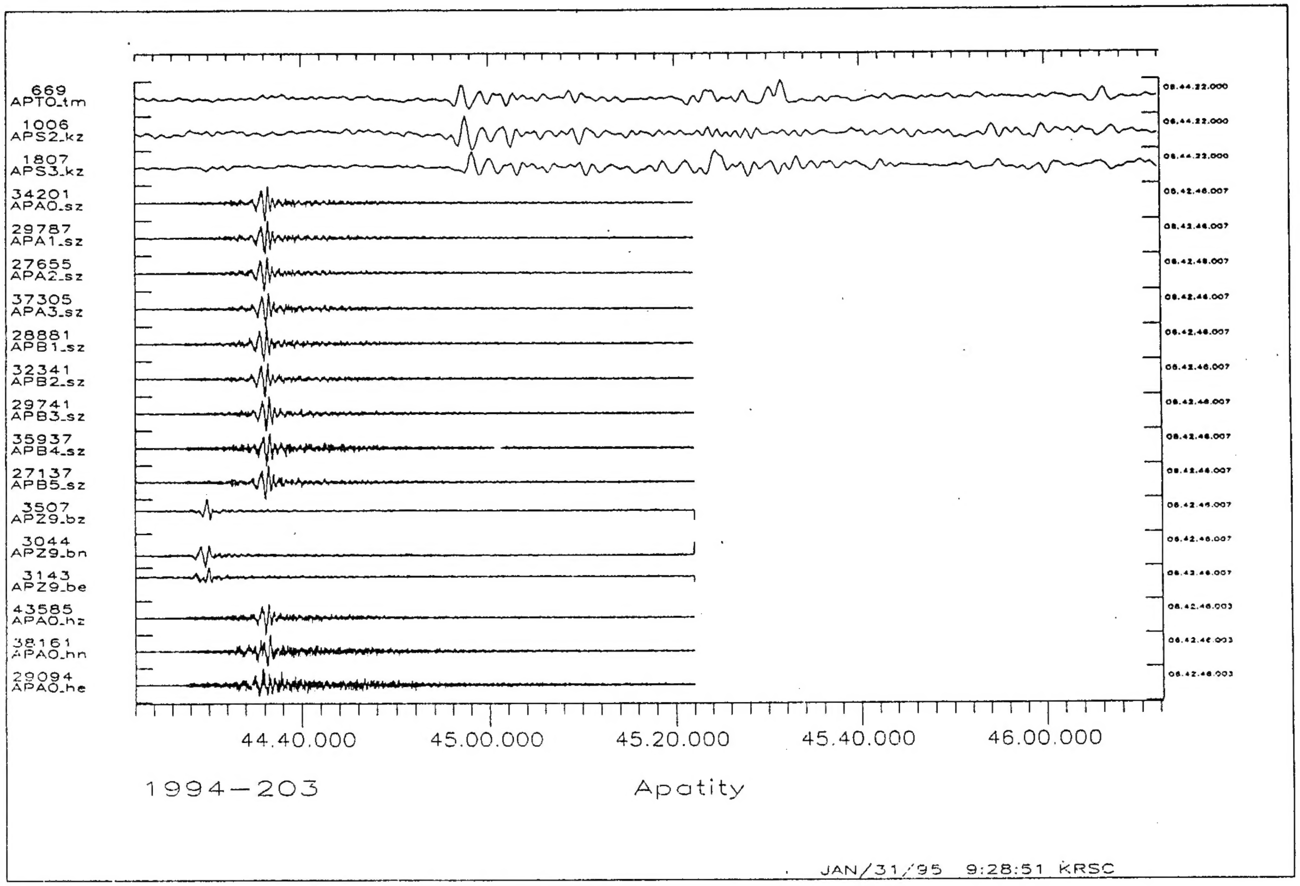

Fig. 7.7.6 Quarry explosion at the Rassvumchorr plateau (Khibiny Massif) 22 July 1994. The top three traces are acoustic recordings, the bottom 15 traces are seismic recordings from the Apatity array and the three-component seismic station APZ9 in the city of Apatity.

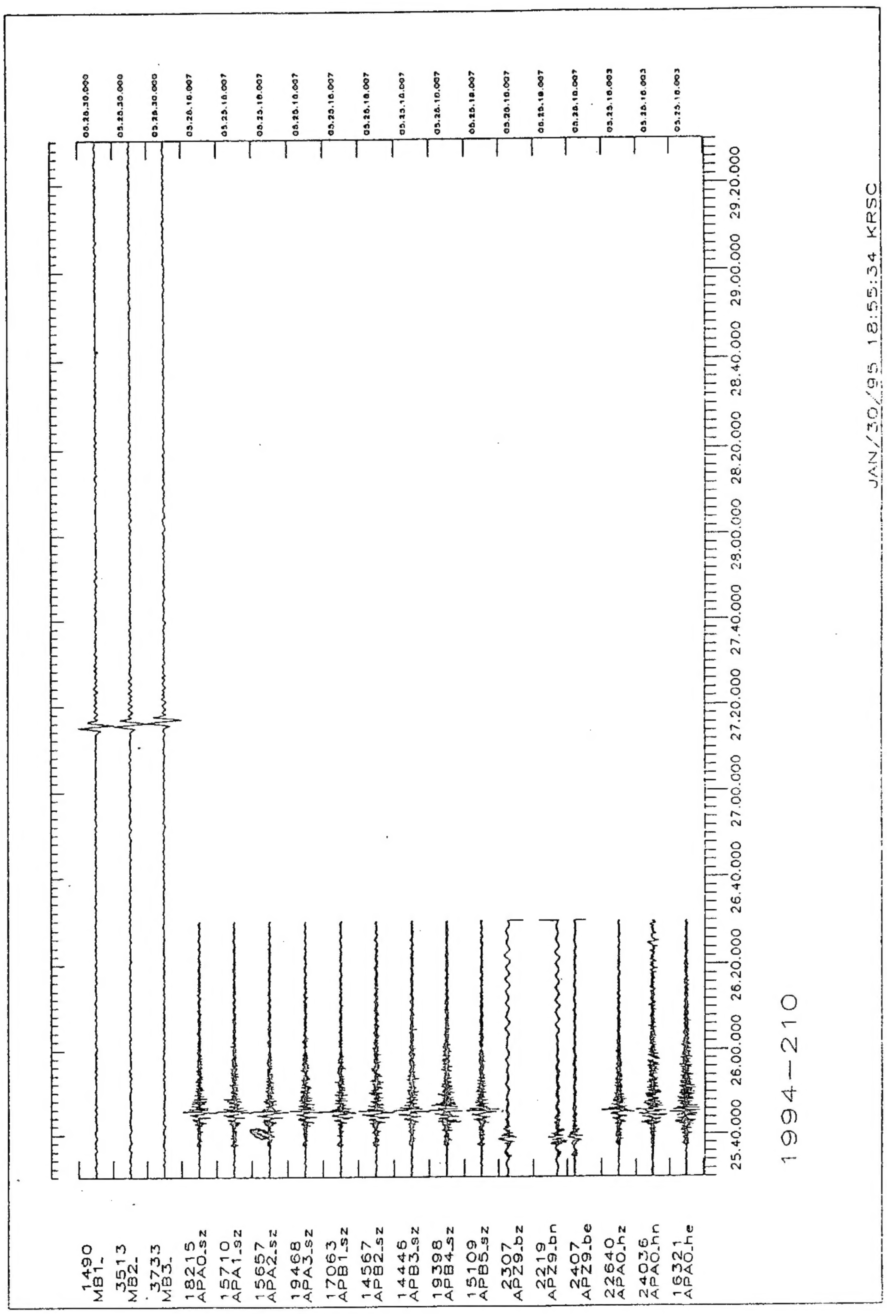

Fig. 7.7.7 Quarry explosion at the Rassvumchorr plateau (Khibiny Massif) 29 July 1994. See Fig. 7.7.6 for explanation.